ISSUE 190 MAY 2009

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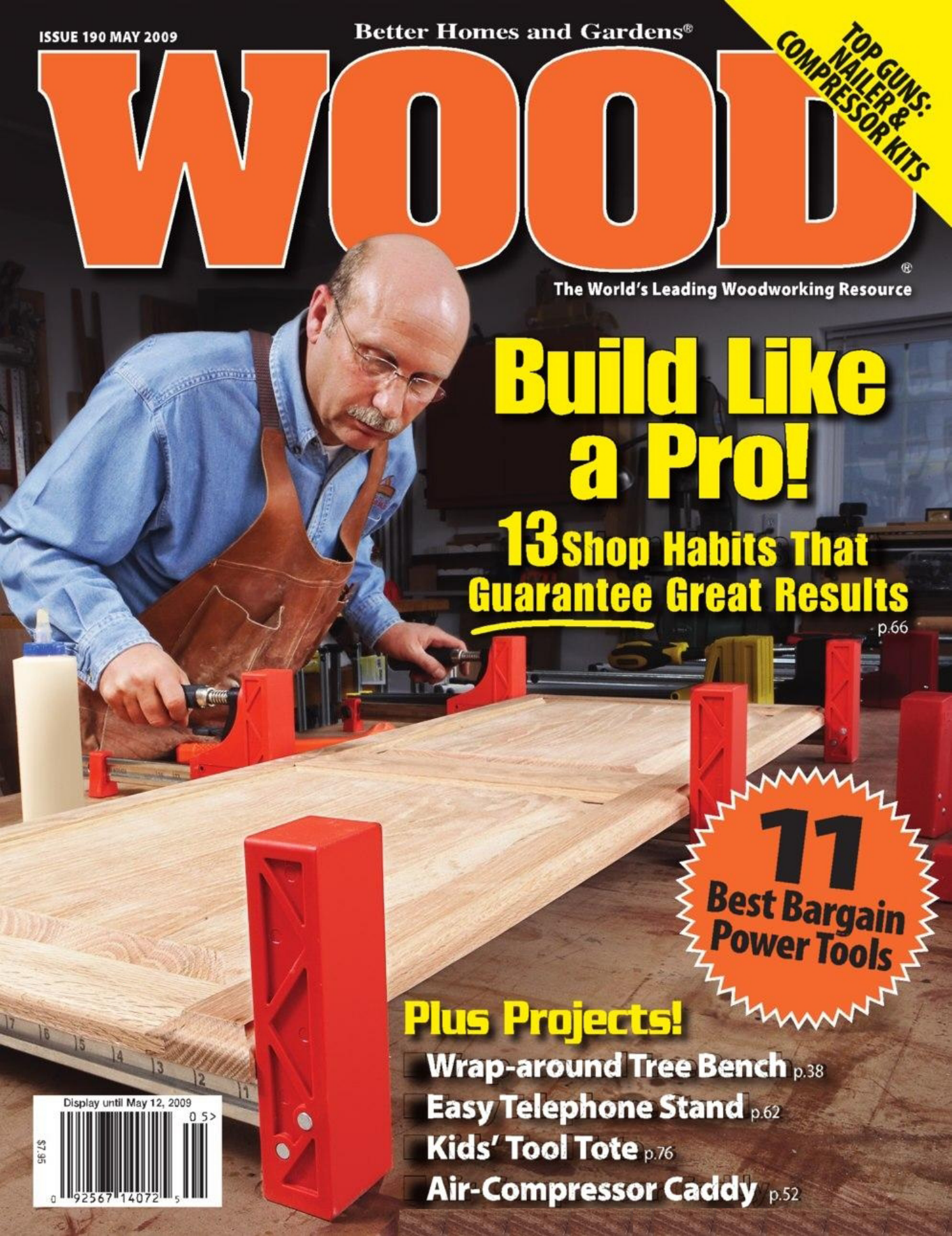
TOP GUNS: NAILER & COMPRESSOR KITS



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May 2009 | Vol. 26, No. 2 | Issue No. 190

Jeff designed and built this laundry-sorting center for a friend.

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Dave built a wall desk for his parents using birch plywood and curly maple.

Bob customized bookcases for his daughters using plans from issues 165 and 187.

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In Memoriam — E.T. Meredith III (1933–2003)

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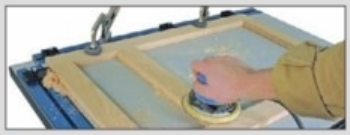
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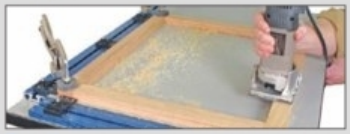
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Editor's Angle

New Developments on the Cyber Frontier

These cutting-edge services make it more convenient than ever to learn and grow in woodworking.

Every day, more of you find your way to the nearly limitless supply of helpful online resources at woodmagazine.com. There you can take advantage of a comprehensive index to past issues, discussion groups for sharing your woodworking questions and advice, project plans, and photo galleries showing the work of other readers—just to name a few popular site features. Now I'm pleased to announce two more breakthroughs.

New video platforms

Some 20 years ago, when I was a tools and techniques editor here at *WOOD*®, we struggled with how to explain tricky skills, such as how to cut a dovetail joint or sharpen chisels, in just words and photos. We wanted to send you videos, but there was no economical way to produce a video and mail it.

Of course, the Internet has changed that forever, making video sharing a low-dough, easy-to-do experience. So for the past couple of years we've offered dozens of short, free online videos. The response has been overwhelming, and now we're ramping things up. Go to our video site today (woodmagazine.com/videos) and you can view an incredible number of videos in four distinct categories:

1. WOOD Cuts. Here you'll find the short (3–10 minute) free videos you're used to seeing on the site. Most of them feature *WOOD* editors and complement articles in the magazine.

2. Better Woodworking. You'll pay a small fee to download these videos (typically 30–120 minutes in length), but you'll find them well worth it. Once downloaded they are yours to keep. You can transfer them to an i-Pod or other portable device for frequent review—in your shop perhaps.

3. WoodTube. More free videos, all created by your fellow woodworkers. You may even want to try your hand at uploading your own shop-shot video.

4. Tool School. Here manufacturers demonstrate how their tools work. These aren't advertisements—you'll learn how some pretty cool tools will improve your woodworking results.

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Subscribers to *WOOD* can now get a free, digital subscription. It's the same content as the paper version mailed to you, but with a few key benefits. For starters, you can electronically clip, save, organize, and share your favorite articles. And, clicking on any Web site shown in articles and ads hot-links you directly to that site. If you live outside of North America and delivery of the magazine takes a while, you can see it as soon as it hits U.S. newsstands.

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Bill Krier

Sounding Board

Our bulletin board for letters, comments, and timely updates

Recycled organ wood finds rest in a cozy rocker

When our church recently replaced its pipe organ, some members of the congregation wondered what could be done with the wood from the old one. I had just received issue 183 (May 2008) of *WOOD* magazine, and being a woodworker and retired pastor, I volunteered to make the rocking chair on *page 36* of that issue.

I made the rocker frame from red oak and the seat slats from the maple foot pedals. It took about 55 hours to complete, and the finished rocker now sits in the church for all to enjoy. In addition, I turned pens from the organ wood and gave one to each person who donated to the organ replacement.

—John Pickrell, Boise, Idaho

Thanks for helping grow my skills and save money

I've been a *WOOD* magazine subscriber for a few years, and can't wait for each issue to arrive. Issue 187 (November 2008) really boosted my confidence as a still-developing woodworker. Following your tips ("Fine-Furniture Accuracy From Any Tablesaw," *page 40*), I tuned up my contractor-style tablesaw to a level I never knew existed. Next, I made the portable router table (*page 6*), then the tapering jig (*page 33*), both shown *below*. With these shop projects in place, I plan to make a bunch of tables with tapered legs. Thanks for helping me become a better woodworker.

—Mike Robino, Pawleys Island, S.C.

Managing Editor Marlen Kemmet has worked at *WOOD* magazine since the inaugural issue.

Hey, *WOOD*® magazine charter subscribers!

At *WOOD* magazine we occasionally hear from readers who have subscribed since our very first issue, back in 1984. Now, as we plan for our 25th anniversary, we'd like to not only *hear* from you long-timers, but we'd also like to *see* you. So if you're a charter subscriber, send us a photo of yourself—holding up your original issue #1 (September/October 1984). We'll try to publish your photo in our anniversary issue. Send your digital images by e-mail to woodmail@woodmagazine.com. Here are some helpful photo tips:

- Use the highest resolution setting on your digital camera.
- Avoid windows, clutter, and distracting elements in the background.
- Hold the magazine near your head, as shown in the photo *above*.
- Watch that the camera flash doesn't reflect on the magazine cover and make it unreadable.

Please work safely

In order to show you precise details in photos, we frequently remove safety guards for the sake of clarity. In your work, be sure to use all safety devices, as well as wearing vision and hearing protection.

—WOOD magazine editors

HOW TO REACH US

For woodworking advice:
Post your woodworking questions (joinery, finishing, tools, turning, general woodworking, etc.) on one of 16 online forums at **woodmagazine.com/forums**.

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Updates to previously published projects:
For an up-to-date listing of changes in dimensions and buying-guide sources from issue 1 through today, go to **woodmagazine.com/editorial**.

Shop Tips

Helping you work faster, smarter, and safer

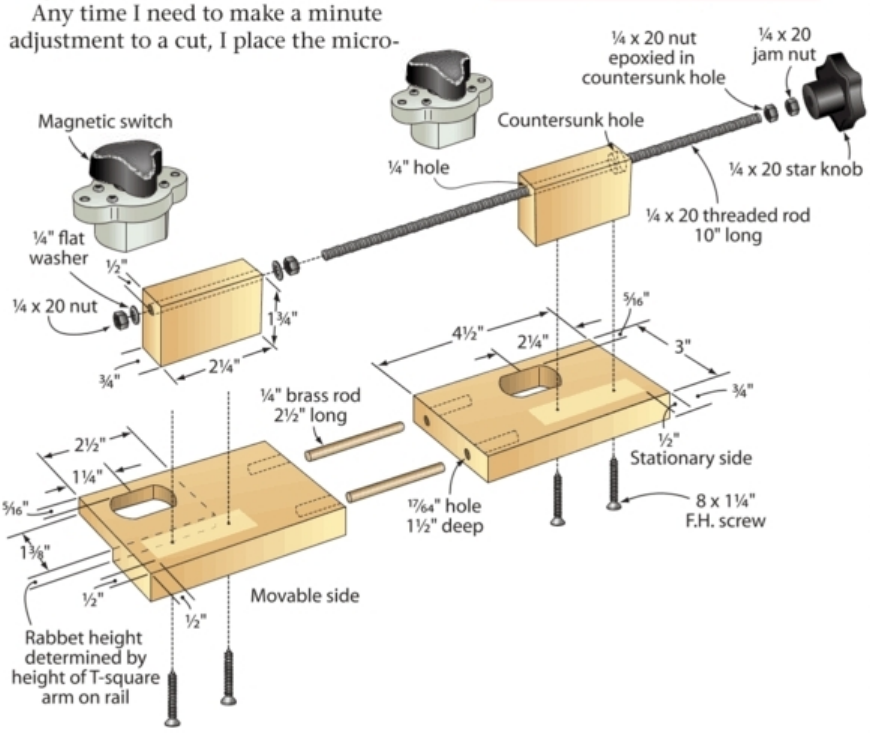
Magnetic micro-adjustments

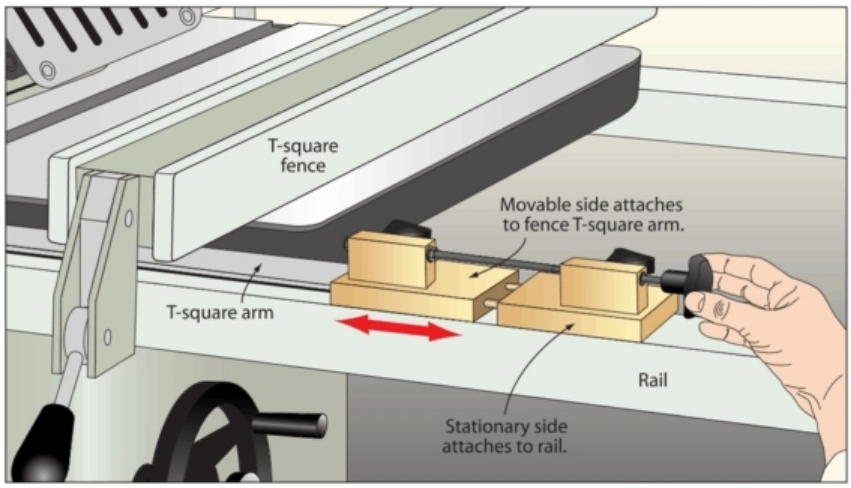
My tablesaw's accuracy improved dramatically the day I got my T-square fence. But I sometimes still struggled with small adjustments using the old "bump and slap" method. This two-part microadjuster gives me the precision I need. The key to the device is the powerful magnetic switches (Magswitch, 303-468-0662, magswitch.com.au).

Any time I need to make a minute adjustment to a cut, I place the micro-adjuster on the fence rail with the rabbet over the T-square arm, and turn both magnets on. By unlocking the fence, and turning the knob, I can move the fence left or right to fine-tune the cut.

—Jerry Spruiell, Atlanta

Top Shop Tip





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The Top Tipster

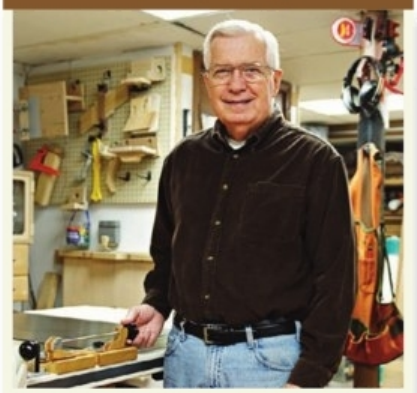

Photo: Rupa K. Photography

Jerry Spruiell began woodworking during his 24-year career in the Army. While he flew the most sophisticated helicopters in the world—everything from Hueys to Black Hawks—his meager tool collection consisted of an underpowered router, a cheap jigsaw, and some rulers. Since retiring though, he's managed to upgrade to a fully outfitted basement shop.

Jerry may not fly choppers anymore, but he'll love this Jet. For sending this issue's Top Shop Tip, he'll receive Jet's 10" dual-bevel sliding compound mitersaw.

Top tips earn tools

Tell us how you've solved a workshop stumper. If we print it, you'll get $100 and a copy of *450+ Best-Ever Shop Tips* (woodmagazine.com/450tips). And, if your idea garners Top Shop Tip honors, we'll also reward you with a tool prize worth at least $300.

Send your best ideas, along with photos or drawings and your daytime phone number, to: **Shop Tips, WOOD Magazine, 1716 Locust St., LS-221, Des Moines, IA 50309-3023**. Or, by e-mail: shoptips@woodmagazine.com. Include your contact info in the e-mail.

Because we try to publish original tips, please send your tips only to *WOOD*® magazine. Sorry, submitted materials can't be returned.

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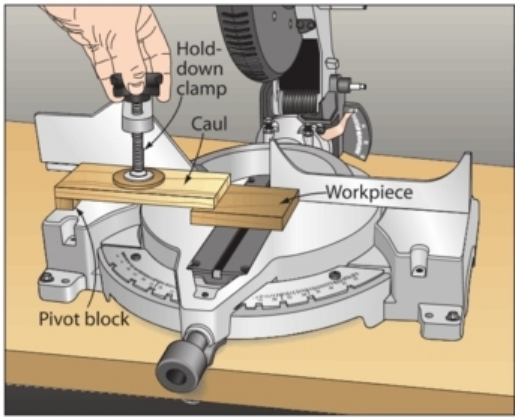
Shop Tips

Finger-saving hold-down extension

When I'm trimming the end off of a short piece at my mitersaw, often the saw's hold-down clamp won't reach the workpiece. To remedy this, I attach a short scrap the same thickness as the workpiece to a clamping caul long enough to bridge the gap, as shown. For added stability, I epoxied a 2" wood disk to the pad of the hold-down.

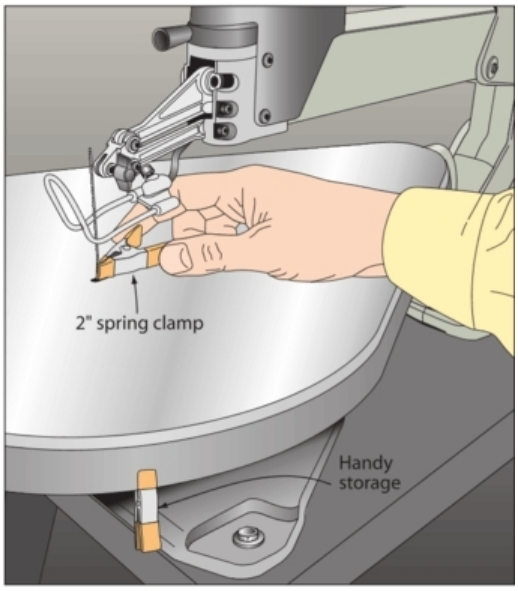
—Luis Padilla, Albuquerque, N.M.



Small-clamp cure for clumsy fingers

Changing scrollsaw blades without dropping them through the table is difficult for those of us with large hands. But a miniature spring clamp makes a great handle for manipulating the blade, or it can hold the blade in position all on its own by resting on the table.

—Bob McCray, Tulsa, Okla.

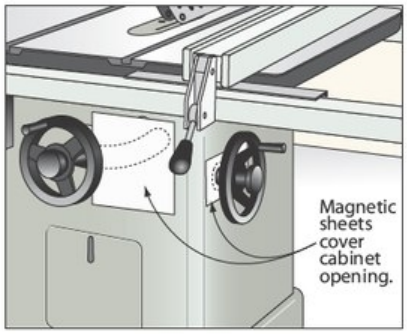


An attractive solution seals up the saw

Even with a good dust collector connected to my cabinet-style tablesaw, a fair amount of sawdust still escaped through the various openings in the cabinet. To close these loopholes, I used magnetic sheets, available at craft stores or as air vent covers at the hardware store.

I cut the sheets just wide enough to cover the curved openings in the front and back, and stuck them in place. When I need to tilt the blade for a bevel cut, I just pull off the covers and lay them back when the angle is set.

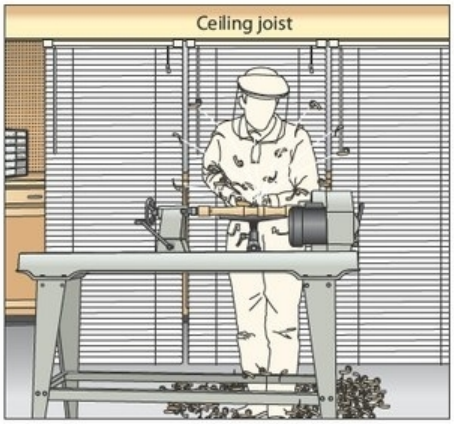
—Chaz Smith, Altoona, Pa.



Shield your shop from lathe shavings

I finally got fed up with shavings flying all over my shop when I'm at the lathe, but I didn't want a bulky wood or cardboard shield taking up space. Instead, I mounted some old window blinds to a ceiling joist behind my lathe workspace. Now, before I start a turning project, I lower the blinds to deflect the shavings. When I'm finished, I simply raise the blinds up out of the way.

—Ron Altier, West Lafayette, Ohio



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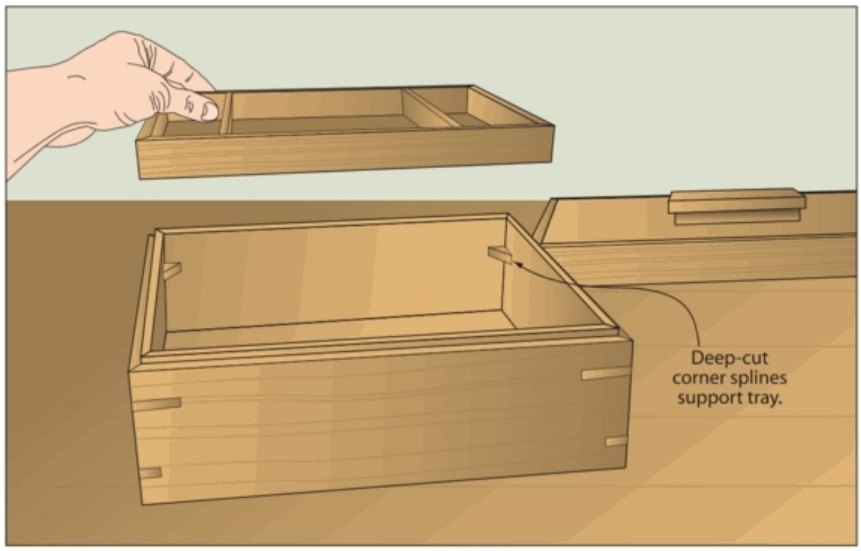
Shop Tips

Form and function meet in jewelry box modification

I've made an alteration to my box design that is both decorative and functional. By making the top corner splines deeper, they protrude slightly into the interior of the box. This makes them the perfect resting place for the box's tray.

—Howard Baker, Valdese, N.C.

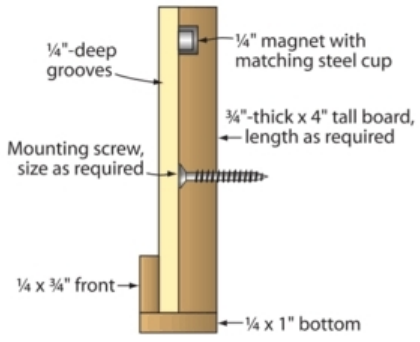


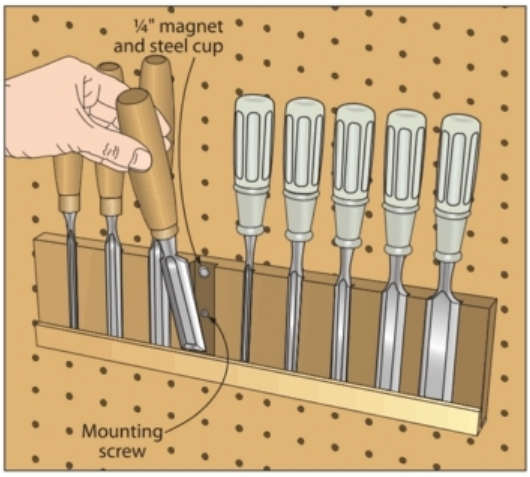
Space-saving, edge-guarding chisel holder

I redesigned my wall-mounted chisel holder so it protects the chisels' cutting edges, but only requires minimal clearance above the chisel handles.

In each chisel slot, I drilled a hole to accommodate a ¼"-diameter rare-earth magnet with a matching steel cup (Lee Valley Tools, no. 99K33.10, $3.30 for 4 sets, 800-871-8158, leevalley.com). When mounted to the wall, the magnets secure the chisels with the cutting edges protected, but the chisels lift out easily without interfering with any tools that are mounted above.

—Bob Catterson, Pewaukee, Wis.



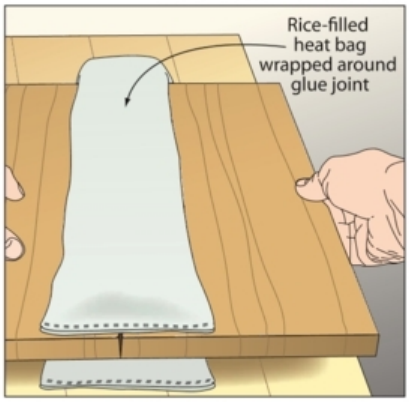


Good for your muscles, but bad for your joints

I recently had to take apart an edge-glued panel because of a mistake. Unfortunately, modern wood glues hold so tenaciously that the wood breaks before the glue joint. The solution my wife gave me was a bit less drastic than splintering the panel or cutting out the joint.

She lent me a heat bag that she uses for sore muscles—a small cloth bag she made from a pillowcase and filled with 3 or 4 pounds of rice. At her suggestion, I heated it in the microwave to the point it was almost too hot to handle. I then wrapped the glue joint with the hot bag and let it sit for about 15 minutes. The heat softened the glue, and the joint came apart easily without any damage to the wood.

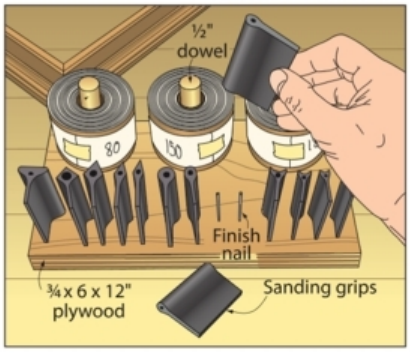
—Richard Harris, Middletown, R.I.



The devil in the detail-sander storage

I finally got tired of my collection of detail-sander grips rattling around loose in a drawer, so I came up with this simple holder. Finish nails with clipped heads make up the pegs for the grips, and dowels organize the rolls of abrasive.

—Serge Duclos, Delson, Que.



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Finishing School

How to Fix Flaws in Film Finishes

An ounce of prevention … well, you know the rest. But if you still get runs and misses, try these tips to avoid sanding back to bare wood.

You're not alone if you examine a newly finished project from every angle for drips, runs, and sags. On a good day, you sigh with relief; on a bad day, you groan with disappointment.

Avoiding problems in film finishes proves much easier than fixing them—even with these techniques—so plan to succeed with these preparation basics:

- You can't avoid what you can't see, so work under strong reflected light, as shown at *right*. Move the light to reflect off each surface as you finish it.
- Apply finishes to horizontal surfaces whenever possible—even if that means laying a project on its side to finish it. That still takes less time than removing runs and starting over.
- Thin finishes up to 10 percent to help brush marks level off, but don't over-thin a finish unless you plan to wipe it on. More brushed-on coats mean more opportunities for mistakes.
- Avoid sanding sealers, especially over stained wood. Instead, apply a full-strength or slightly thinned coat of the same finish you'll use for the remaining coats. You're less likely to sand through these than a thin layer of sanding sealer while removing any imperfections.

NOW YOU SEE DRIPS; NOW YOU DON'T

Glare from an angled light (*left*) highlights a finish drip that could have been brushed out if caught in time. The same drip disappears beneath an overhead light (*right*).

LAY FINISH AWAY FROM ENDS; THEN BRUSH BACK

Start a stroke away from the end to avoid drips (*left*). Then brush back over the pool of finish on the surface to the end (*right*).

Don't rush the brush

Old-time painters didn't talk about brushing on a finish; they *laid* it on using the brush as a carrier.

Prepare the brush by slapping the dry bristles against your palm to reveal loose ones. Then submerge the bristles in solvent suitable for the finish you'll use—mineral spirits for oil-based polyurethane, for example. Squeeze the bristles with a clean towel to remove the excess solvent. This rinses debris from the brush and helps make the brush easier to clean later.

Pour finish into a separate container to avoid contaminating the original can with your brush. Dip the bristles about half-way into the finish, and draw off the excess against the container rim. Apply finish near one edge about 4" from an end, as shown *above left*. Then brush back toward the end without forcing drips of finish off the wood.

continued on page 19

SQUEEZE OUT EXCESS FINISH

An overloaded brush can leave behind drips and pools of finish. To drain it, drag the bristles against the edge of a clean container.

"TIPPING OFF" EVENS THE FINISH

Immediately after applying finish to an area, lightly drag just the bristle tips over that area to even the finish and remove bubbles.

Lay finish thick enough to cover the wood and level off, but not so thick that it pools on the surface. If you've applied too much finish, immediately unload the bristles into a dry container, as shown *above*, and brush back over the surface to pick up the surplus.

As soon as you've applied finish to an area, help remove bubbles by "tipping off" the finish using the bristle tips drawn lightly across the surface, as shown *above*. This will eliminate most problems before they start and it helps level off the surface.

Fixes for small flaws

Despite your best efforts, stray drops of finish can harden into a bump, or an overflowing brush can leave a sagging lump on the underside of an edge. Try these fixes only after the finish dries at least a day or two to avoid marring a soft surface. Because film finishes dry at the surface first, what feels dry on top could cover a gummy layer underneath.

To remove bumps anywhere on a panel, make a finish "shaver" from a wooden block double-faced-taped to a newly cut piece of glass about 4×5". The sharp glass edge slices through bumps and large dust nibs, as shown on *page 18*. But the flat face doesn't dig into or scratch the surrounding finish.

For bumps near an edge, another option is to shave them off using a sharp, burr-free chisel. Lay the chisel flat on the surface bevel-side up, and guide the edge against the bump at an

continued on page 21

CHISELS LEAVE A CLOSE SHAVE

The flat back keeps the chisel edge from digging beneath the surface. Then lightly sand the drip on the profile with 220 grit.

STRIP FINISH WHILE IT'S FRESH

Use a metal scraper with a light touch on flat surfaces when stripping a finish. You should only have to resand using the final grit.

angle, as shown *above*. Allow the newly exposed area to harden overnight, sand it smooth with 320 grit, and apply another coat.

For gaps in the finish—usually near the edges—scuff sand the finish around the gap with 320-grit sandpaper without touching the bare area. Then apply finish to the bare wood, feathering the wet edge against the edge of the cured coat. Allow the finish to dry one day before lightly sanding the surface smooth and applying another full coat.

Drastic action for big flaws

Because polyurethane hardens slowly, there's always a "whoops window" when a machine may kick dust into the air, outdoor breezes may deposit debris on a fresh finish, or a project part may tumble finish-side-down to the floor. If you catch the problem while the surface remains tacky or wet, remove the finish immediately with the appropriate solvent, and try again.

If you discover a major problem after the finish skins over or hardens, then it's time to start over. For flat, unstained surfaces, simply sand off the problem or remove it using a cabinet scraper. If you opt for sanding, check your abrasive frequently for finish build-up and clogging that can damage the wood.

On rounded corners or hard-to-sand areas, apply a furniture stripper to remove the finish while it's still curing. Following the manufacturer's directions, carefully apply stripper to only the flawed surface. Allow the finish to dissolve, and scrape it from flat surfaces using a plastic or dull metal putty knife, as shown at *near left*. To remove stripper from crevices, use a sharp sliver of wood. Wipe the remaining stripper away with a coarse burlap cloth.

After using a methylene chloride product, such as the one we used here, rinse the surface with mineral spirits or naphtha to remove leftover stripper and break up waxy stripper residue. By scraping carefully, you can lightly sand the stripped surface using 220-grit abrasive to knock down any raised grain. Then, older and wiser, you're ready to apply a fresh coat of finish.

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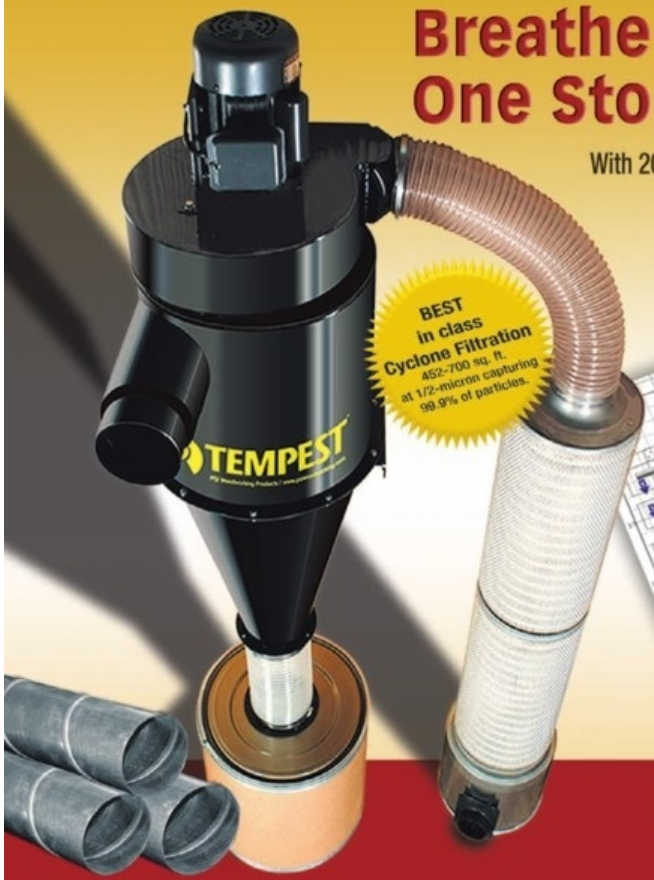

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Cut Gap-Free Bevel Joints

Set your saw to cut accurate bevels for no-gap joints on projects with four or more sides.

When cutting parts for multi-sided projects, success comes from setting your saw blade within fractions of a degree. With the tools and technique shown here, you'll achieve that accuracy in five easy steps.

1 Make the throat plate flush with the saw table. Then mount a wooden extension on your miter gauge face, and square it 90° to the blade.

2 Unplug the saw and use its built-in gauge to tilt the blade to the approximate angle. Then fine-tune the angle one of two ways:

3 Use a protractor and the conversion chart at *right* to set a sliding bevel. Position the sliding bevel blade against the saw blade body, as shown *above*. Or you can zero a digital angle gauge on the saw table (not the throat plate), and then attach it to the blade. Keep the corner of the gauge against the throat plate, as shown *below*, so it doesn't rotate with the blade.

4 To test your settings, rip scrap strips the same width and thickness as your project parts, and divide them into sections about 8" long. Use your miter gauge to cut a bevel on one end of each test piece. Then attach a stop block to the miter fence, and cut a bevel at the opposite end of each piece so they're all the same length.

5 Divide the pieces into two equal groups (or nearly equal, for odd-numbered sides). Tape the outside corners together to assemble each group, as shown *below*. Butt the untaped ends of each half-circle together and check for gaps along the edges and ends. If there's a gap at the inside or outside of the butted joints, adjust the blade tilt, as shown *below right*. Make small angle changes, though. You multiply each adjustment 16 times for an octagonal project, for example. Recut the test bevels until you achieve a gap-free fit.

Turn protractor readings into bevel angles

For projects with this many sides…	Saw bevel gauge reads…	Protractor reads…	Digital gauge reads…
4	45°	45°	45°
5	36°	54/126°	54°
6	30°	60/120°	60°
7	25.7°	64.3/115.7°	64.3°
8	22.5°	67.5/112.5°	67.5°
10	18°	72/108°	72°
12	15°	75/105°	75°

You can translate protractor or digital angle gauge readings into blade tilt angles on your tablesaw by subtracting them from 90°.

Sources

Protractor. Square-head steel protractor no. 17, available at home centers. General Tools, 800-697-8665 or generaltools.com.

Digital angle gauge. Wixey model WR300, $40, wixey.com.

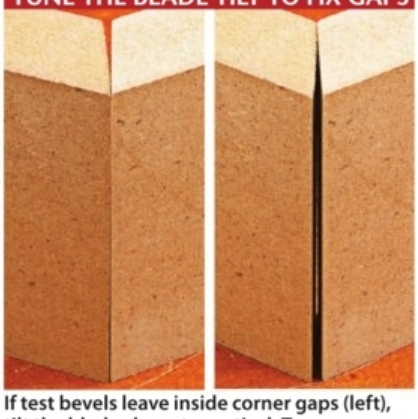
MEASURE IN TENTHS OF A DEGREE

Brace an electronic angle gauge against the throat plate so it doesn't accidentally rotate and produce a false reading.

BUTT THE HALVES TOGETHER

Tape two halves made from test scraps; then butt the halves together to see where gaps develop. Avoid flexing the two halves.

TUNE THE BLADE TILT TO FIX GAPS



If test bevels leave inside corner gaps (left), tilt the blade closer to vertical. To cure gaps on the outside corner, tilt the blade more.

Foil Door Foul-ups

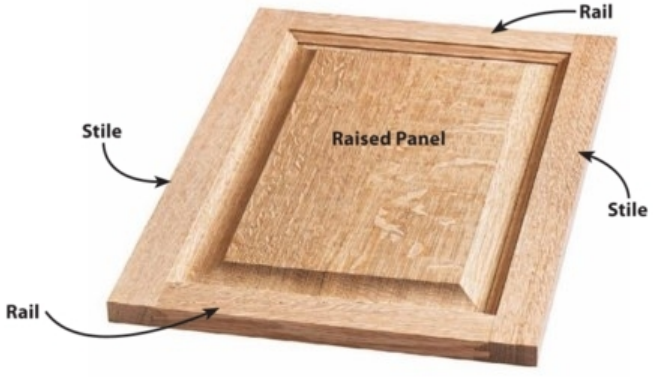
Turn out flawless raised panels and frames every time.

When making raised-panel doors, it's best to head off mistakes before they happen. Here's how.

Goof-proofing starts with good habits

- Without square ends cope-and-stick joints will not align properly. So, crosscut rails square and to final length before routing the coped ends that match the stick profile on the stiles.
- Size the rail-and-stile frame to fit the door opening, and then size the raised panel to fit that frame.
- Use straight-grained stock for stiles and rails to best resist warping.
- If you intend to strengthen the cope-and-stick joints with loose tenons or dowels, cut the mortises *after* routing the profiles. This prevents tear-out around the mortise and keeps the router bit bearing from dropping into the mortise and botching the profile.

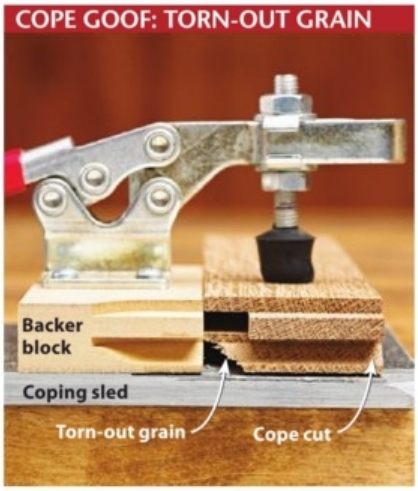
RAISED-PANEL DOOR ANATOMY



Fend off frame errors

GOOF: Despite using a backer board, tear-out leaves chunks missing from the edge profile.

COPE GOOF: TORN-OUT GRAIN



HOW TO AVOID: You'll need to use a coping sled or shopmade jig to hold rails as you make the cut, but even with a backer block it's not a guarantee against tear-out. One way to help prevent this is to always rout the coped ends of the rails before routing the stick profile on the edges. Otherwise, the gap between the profile and the backer negates the zero-clearance benefits of the backer board.

COPE SOLUTION: CUT ENDS FIRST

continued on page 25

GOOF: Rail and stile surfaces don't match up perfectly.

NO PRIDE IN PROUD RAILS

HOW TO AVOID: Always rout rails and stiles with the front face down on the router table. That way, any thickness difference will be on the backside of the door. Also, use hold-downs and hold-ins while routing the edge profiles to ensure even profiles by preventing lifting or shifting.

Prevent panel mishaps

GOOF: Tear-out occurs at corners when routing the raised profile.

HOW TO AVOID: Always begin routing a panel profile on end grain, and then "chase" it around the perimeter of the panel. Any tear-out at an intersection will be removed when you rout the adjacent edge. Also, remove the material in ⅛"-deep increments to limit tear-out.

continued on page 26

PANEL GOOF

PANEL SOLUTION

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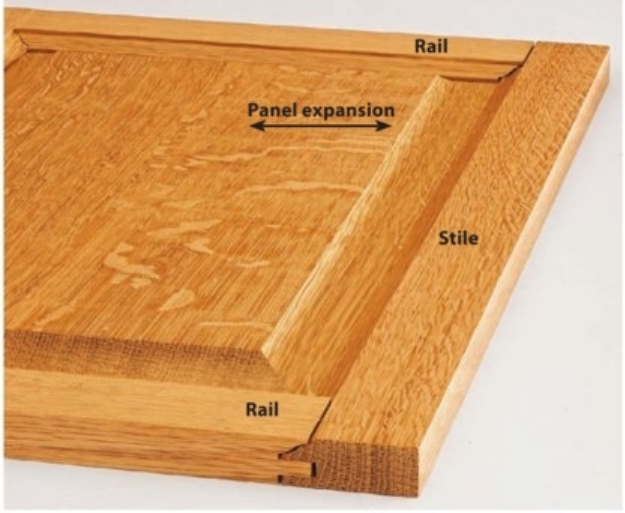
Avoiding Workshop Goofs

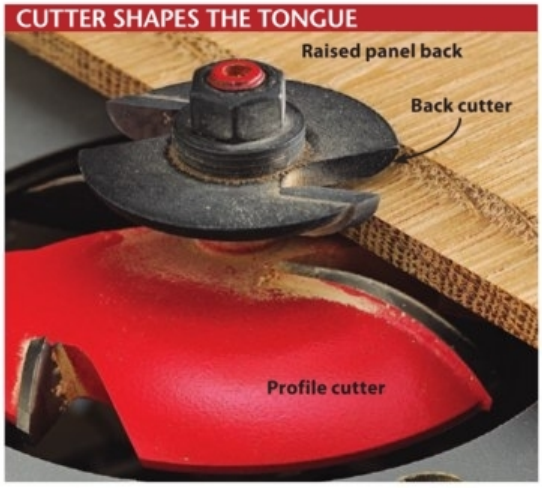
GOOF: Panels fit too tight in the frame grooves, and expansion pushes the joints apart.
HOW TO AVOID: Cut panels to size allowing for ⅛" expansion side-to-side (across the grain) and 1/16" top-to-bottom (along the grain). Use a panel-cutting bit with a back cutter for a tongue perfectly matched to the frame grooves. Remove material in ⅛" increments, using a test board with each depth or height adjustment.

PANEL EXPANSION DISASTER



GIVE PANELS BREATHING ROOM

CUTTER SHAPES THE TONGUE



From Knotty to Nice

Get as much clear lumber as possible from knotty woods.

The Materials List for the Tree Bench project on *page 38* shows an ideal layout on perfectly clear cedar. But how do you find such mythical wood without paying a small fortune at the home center? Our secret: We don't.

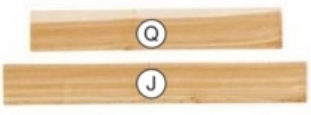
Starting with inexpensive, rough-milled cedar, work around the knots, minimizing wasted wood, time, and money. Here's how.

1 Seek out the clearest boards, but don't go overboard. In some woods, such as pine and cedar, knots are expected—even desirable. But avoid loose knots or those that might compromise project integrity.

Lay masking tape on your mitersaw table and mark the rough length of your project parts. The distance between the blade and the mark acts as a window revealing the most knot-free lengths.

2 Buy boards at least twice as wide as you need; then rip them down the center to rough width. This often puts knots on the outer edges of the board where they can be trimmed away more easily.

3 Crosscut the project parts to rough length, using the method shown *at top right* to speed the task. Where knots are unavoidable, work to position them on the edges or ends of the workpiece where they might be removed or reduced in final sizing.



4 Finally, choose the clearest face. Then plane, joint, and cut project parts to final size being mindful of opportunities to remove more knots. Here are the actual Tree Bench parts we managed to cut starting from a 1×8×96" board. With 30 percent waste from very knotty wood, we still managed to save money over expensive select lumber.

Wise Buys

Our Editors Test

Nailer/Compressor Combo Kits

Why buy?

Unless you're using a spray gun, pneumatic sander, or framing nailer, a small, portable air compressor handles your nailer needs just fine. And because you might need more than one type of nailer, these combo kits offer real value. Each tested kit comes with a 2- to 6-gallon compressor, hose, an 18-gauge brad nailer, and another nailer or stapler for much less than you'd pay if buying each item piecemeal. Because most kits come with a stiff PVC hose that is difficult to work with, we suggest replacing it with a good ¼" or ⅜" rubber hose that'll cost about $30.

BOSTITCH CPACK300, $300

Editor test-drive:

INCLUDES: 6-gallon compressor; 16-gauge 1–2½" finish nailer; 18-gauge ⅝–2" brad nailer; 18-gauge ½–1½" narrow-crown stapler; ¼"×40' hose; canvas bag; and fasteners.

I could drive 25 2½" finish nails, 40 2" brads, or 35 1½" staples before the oil-free compressor engaged. Even though this model was comparatively quiet at 82 dB, it's still a good idea to wear hearing protection. The nailers all have effective depth adjustments and moveable exhaust ports, but few other frills. Only the finish nailer has a quick-release to clear jams—although I could never jam it—and all will dry-fire when out of fasteners, shortening the nailer's life and leaving pockmarks on the workpiece. Despite weighing 38 pounds, the compressor is easy to carry.

—Tested by Bob Hunter, Tools & Techniques Editor

To learn more:

800-556-6696; bostitch.com

PORTER-CABLE CF6330, $300

Editor test-drive:

INCLUDES: 6-gallon compressor; 16-gauge 1–2½" finish nailer; 18-gauge ⅝–1⅜" brad nailer; 18-gauge ½–1¼" narrow-crown stapler; ¼"×40' hose; canvas bag; and fasteners.

The nailers in this kit surprised me because they're more robust than my older nailers. The lightweight magnesium bodies held up well under fire. The finish nailer and stapler sport quick-releases for clearing jams, and on the bradder and stapler, a red flag appears in a small window to indicate low fasteners. Although none will bump-fire, you can get an optional trigger to do so with the finish nailer. The 28-pound oil-free compressor proved easy to carry, but tended to scoot when refilling, and its test-high 91 dB equals the noise of a router.

—Tested by Craig Ruegsegger, Multimedia Editor

To learn more:

888-848-5175; deltaportercable.com

DEWALT D55141FNBN, $280

Editor test-drive:

INCLUDES: 2-gallon compressor; 16-gauge 1¼–2½" finish nailer; 18-gauge ⅝–1¼" brad nailer; and ¼"×25' hose.

This small, oil-free compressor nevertheless weighs 31 pounds thanks to a stout tank and motor. It's also louder than I expected at 85 dB. Still, its compact size and easy-to-grab handle makes it easy to lug into the house, basement, or jobsite with no trouble. I could fire only 15 1¼" brads or nine 2½" finish nails before the pump kicked on, but it had no trouble keeping up with every job I did. With two quick-connect ports, you could hook up both nailers (with another hose), but the small tank would not support two people steadily using those nailers simultaneously. Both nailers feature easy-to-adjust depth controls and quick, toolless jam clearing.

—Tested by Bill Krier, Editor-in-Chief

To learn more:

800-433-9258; dewalt.com

MAKITA MAC700K3, $350

Editor test-drive:

INCLUDES: 2.6-gallon compressor; 18-gauge ⅝–2" brad nailer; 18-gauge ⅝–1½" narrow-crown stapler; and ¼"×25' hose.

There are enough ear-piercing machines and tools in my shop, so I was thrilled with the smooth, quiet performance of Makita's oil-lubed hot-dog-style compressor. Thanks to a small muffler, this model topped out at 72 dB, more than three times quieter than the next-best unit in the test. Although it's hefty—a test-high 53 pounds—it's the beefy components that make it so: heavy-gauge steel, copper tubing, and tubular steel handle. Both nailers have effective non-marring rubber noses, but neither will bump-fire in rapid succession. Only the brad nailer has a quick-release for clearing jammed fasteners.

—Tested by Kevin Boyle, Senior Design Editor

To learn more:

800-462-5482; makitatools.com

Great Ideas for Your Shop

Easy-to-store Folding Work Table

For assembly work, Jeff Tobert of Spruce Grove, Alberta, designed this simple knockdown table. The removable worksurface and collapsible end assemblies allow the base and top to be stacked flush against the wall when not in use. Jeff built the table to match the height of his tablesaw so it could also be used as an outfeed table. If that's not important to you, and you envision using this for assembling furniture pieces, cut the uprights of the side and end assemblies to a length comfortable for your back instead of 30". The four adjustable cabinet levelers compensate for an uneven shop floor. To keep the weight manageable, Jeff used a hollow-core door for the top, and 1×4 base construction, making it easy to single-handedly make room in the garage for the family car.

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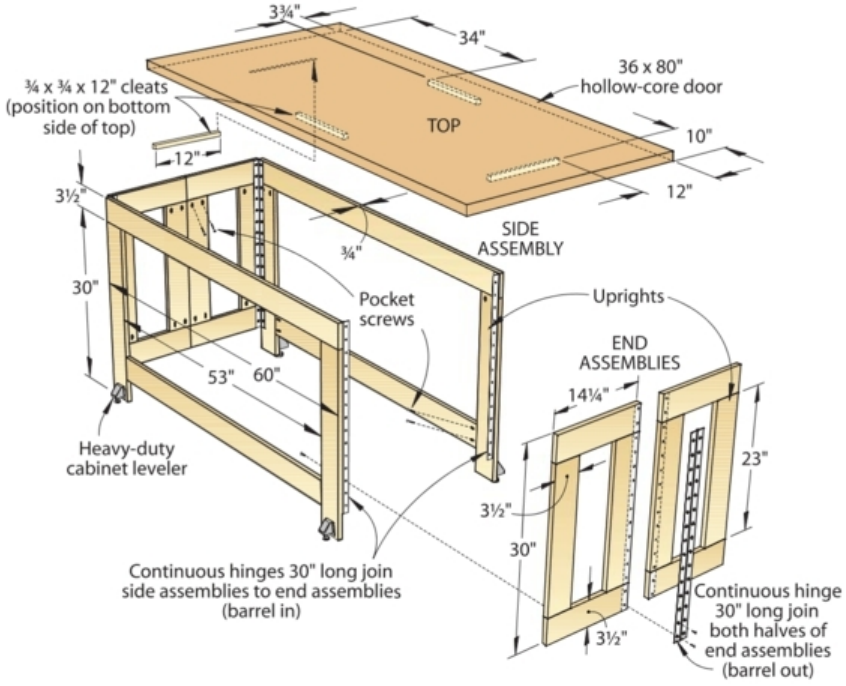


Top Buys in 6 Basic Power Tools

Don't wait until you can afford a shop full of pricey pro-level tools. You can start crafting high-quality woodworking projects with these six basic (and inexpensive) tools.

So, you've started a power tool collection and are now wondering where to put that hard-earned cash next. How do you avoid buying junk or breaking the bank? To answer that question, we tested a raft of low-cost portable power tools to see which offers the most performance for the money. Along with a few basic hand tools and accessories, these six power tools enable you to make any of the high-quality Basic-Built projects featured in every issue of *WOOD*® magazine.

1 Take the tool to the work with a circular saw

Don't discount the circ saw as just a rough-cutting tool for breaking down sheet goods into manageable size. With the proper adjustments and techniques, you'll be making clean, accurate rips and crosscuts every time.

The best circular saws with 12 or more amps of power will cut through even 2"-thick hardwood. But in addition to muscle, demand clean, accurate cuts. To that end, look for quick and intuitive depth-of-cut and bevel adjustments, an unobstructed view of the cutline, and a comfortably light weight. We recommend replacing the factory-supplied blade with a premium, thin-kerf, carbide-tipped, 40-tooth blade for general-purpose work (we used Freud's TK303 when testing the eight saws: $20, 800-334-4107, freudtools.com).

—Tested by Steve Feeney

▲ Best Value: Skilsaw 5580-01, $65
The 13-amp 5580-01, *above*, had no trouble cutting anything we threw at it. It readily met our standards for power, ease of adjustment, and comfort. With a blade upgrade, a shop-made straightedge, and a taped, well-supported cutline, we made clean, arrow-straight cuts.
877-754-5999, skil.com

▼ Upgrade: Makita 5007MG, $150
The 5007MG steps you up to a more powerful 15-amp motor and more bevel range (0–56°). The large, soft grips make this easy-to-adjust saw comfortable to use, while magnesium components make it rugged but light in weight.
800- 462-5482, makita.com

The tablesaw: quick setup and repeatable accuracy

For accuracy on smaller project parts, it's time to bring in a larger tool: the tablesaw. When you add a tablesaw to your arsenal, you gain the ability to quickly set up accurate and repeatable rips, crosscuts, bevels, miter cuts, dadoes, grooves, and rabbets.

Most seasoned woodworkers will tell you that if you're going to invest extra bucks anywhere, put your money into a good tablesaw. Mid-priced ($150–$300) portable tablesaws offer accuracy at an affordable price, while maintaining their small, stowable size.

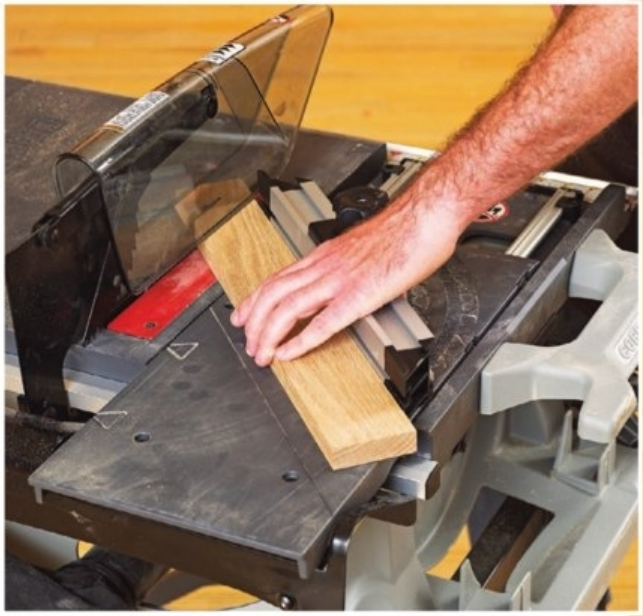
Power and accuracy rule when choosing a portable tablesaw. Most use a direct-drive, universal motor like those in handheld power tools. We tested the power of five saws by pitting them against 2"-thick oak, and eliminated those that, when pushed, frustratingly stalled mid-cut.

Likewise, you'll quickly grow irritated by a flexing fence or an out-of-square miter gauge. The quality of these components is especially important on portable tablesaws that can't be upgraded with an aftermarket fence or miter gauge.

Finally, consider capacity. We recommend at least 24" of rip capacity for cutting sheet goods in half. Most benchtop models can crosscut pieces up to about 8" wide.

As with the circular saw, you'll want to switch out the manufacturer's blade for a premium blade for smooth, splinter-free cuts.

—Tested by Steve Feeney



▲ Best Value: Craftsman 21806, $290
With the most cutting power of any saw at this price, the smooth-running 21806 also offers best-in-class cutting capacities. The right table extends to accommodate a 30" rip cut and the sliding left table, shown *above left*, more than doubles the typical benchtop-saw capacity for crosscuts on short workpieces. The sliding table had no play and produced accurate miters and crosscuts. And the tightly locking fence showed no deflection in our tests. The 21806 comes equipped with a sturdy collapsible stand and attached wheels.
Visit a Sears store or craftsman.com

◀ Upgrade: Contractor-style saw
You can buy pricier portable saws than the Craftsman 21806, but if you've got that much cash, upgrade to a contractor's saw. A saw in the $500–$800 range could serve you for decades. You'll give up some portability and compactness, but you'll gain a quieter, more-powerful induction motor; a larger cast-iron table for better workpiece support, a much stouter rip fence; greater cutting capacities in every direction; and heavier, vibration-dampening construction. At $775, the Grizzly G0576 fits the bill nicely.
800-523-4777, grizzly.com

3 The router — What *can't* it do?

One of the most versatile tools in woodworking, a router cuts a variety of joints, adds decorative shape to edges and trim pieces, duplicates parts, joints edges, and much more.

For maximum versatility at a minimum price, pick a two-base kit that includes a motor and interchangeable fixed and plunge bases. Both bases give you microadjustable depth control. The plunge base lets you make cuts that start and stop short of the workpiece edge, while the fixed base can be mounted in a router table, adding even more to your tool arsenal. Look for a kit with plenty of power to hog away the material and a comfortable, in-control feel. Check the ease-of-use factors, such as quick bit changes, depth-of-cut settings, and smooth plunging.

—Tested by Bob Hunter

▲ Best value: Craftsman 17543, $120
Although bit changes and depth setting could be easier to make, the 17543 offers good power, easy base changes, and an LED worklight. Edge-guide and dust-collection attachments—pricey add-ons for other router kits—come included with this one.
Visit a Sears store or craftsman.com

▲ Upgrade: Bosch 1617EVSPK, $220
This kit has power to spare and proves a dream to use with a comfortable fixed base and easy-to-use, balanced plunge base. The controls are within easy reach; the adjustments among the most accurate, repeatable, and simple to make; and the plunge-depth scale easy to read.
877-267-2499, boschtools.com

4 A cordless drill/driver makes parts into projects

Today's multi-talented cordless drills drive lag screws through deck lumber as easily as they tease tiny hinge screws into jewelry box lids. Accessorize it with a good brad-point bit set and some countersinks and you'll be well-equipped to transform that flat stack of project parts into an assembled piece of furniture.

A 12-volt nickel-cadmium (NiCd)-powered drill packs enough punch for common drilling and driving tasks, all while easily squeezing into tight spaces. So you're not interrupted by downtime, get one that includes two batteries. Also look for two speed ranges (for drilling holes and driving screws) and multiple clutch settings to prevent shearing or stripping screws.

—Tested by Doug Hicks

▲ Best value: Hitachi DS12DVF3, $80
The smallest drill in our test, this model drove the most screws and drilled the most holes per charge. The ⅜" chuck will handle most standard bits. And with a 30-minute charge time, the batteries should keep up with you all day. Adding to the value, Hitachi tosses in a flashlight, an 8-piece bit set, and a 5-year warranty.
800-829-4752, hitachipowertools.com

▲ Upgrade: Makita BDF452HW, $200
Upgrading to Lithium-Ion technology, the new darling of the cordless world, doesn't come cheap, but consider the BDF452HW's gains. For about the same size and weight as 12-volt NiCd drills, this comfortable drill jumps to 18-volt power and slashes the charge time to 15 minutes. The ½" chuck accepts larger bits. And the LED worklight brightens up your workpiece.
800-462-5482, makitatools.com

5 Going around the bend with a jigsaw

When a bandsaw's not in the budget, a jigsaw helps you cut affordable curves. Don't worry about gimmicky add-ons—a laser won't help you track around a curved corner. Stick to the basics: Quick, toolless blade changes, easy bevel adjustments, and a clean line of sight unblocked by the shoe. Upgraded models often include niceties such as sturdy blade rollers to prevent deflection or a sawdust blower to keep your cutline cleared. Once again, upgrading to a premium blade, such as Bosch's Xtra-clean (Model No. T308B, 5-pack $14, 877-267-2499, boschtools.com), vastly improves cut quality, reducing blade marks, splintering, and burning.

—Tested by Dean Fiene

▲ Best value: Black & Decker JS515, $30
This bare-bones jigsaw gets the job done. The JS515 had one of the largest depths of cut (2 17/32" with our 4" test blade), excelled at keeping the cutline clear of dust, and sped through easy blade changes.
800-544-6986, blackanddecker.com

▲ Upgrade: Bosch JS5, $100
This jigsaw adds power and comfort to the basic model. The baseplate retracts, getting you closer to obstacles. Optional orbital action speeds through rough cuts. The blade holder stays open until you pop in the next blade.
877-267-2499, boschtools.com

6 Finish it off with a random-orbit sander

Random-orbit sanders prove more aggressive than their quarter-sheet orbital-only cousins at removing machining marks. But they still provide a smooth, scratch-free finish as you work through finer grits of sandpaper.

But even with the added speed of a power sander, nobody wants to linger too long while sanding, so choose an aggressive tool that leaves a smooth, scratch-free finish. And because random-orbit sanders create some of the finest, most breathable sawdust of any tool, good dust collection counts. Finally, a sander should be comfortable, dampening the amount of vibration that gets transferred to your hand.

—Tested by Bob Baker

◀ Best value: Milwaukee 6021-21, $70
This sander scored high marks in all of our key performance categories: aggressiveness, smooth finish, dust control, and comfort.
800-729-3878, milwaukeetool.com

Upgrade: none
You won't need a better random-orbit sander than this.

MORE RESOURCES

FREE VIDEOS

- *Precision Cuts with a Circ Saw Straightedge* at woodmagazine.com/straightedge
- *Fine-Furniture Accuracy from any Tablesaw* at woodmagazine.com/tssetup
- *Perpendicular Holes Without a Drill Press* at woodmagazine.com/perpdrilling

RELATED PLANS

- Great projects you can make with these 6 tools: woodmagazine.com/bbprojects
- Simple jigs and shop aids woodmagazine.com/simplejigs

RELATED ARTICLES

- "6 Basic Skills Every Woodworker Should Know About," issue 183 (May 2008) $
- The accessories: glue, clamps, and fasteners woodmagazine.com/bbaccessories

($ = Download this article from woodmagazine.com/plans for a small fee. Type "basic skills" in the Search box.)

The next four machines to consider

Drill Press: If you think a drill press is just for punching holes, think again. While it does give you a much greater level of control and accuracy for drilling clean, perpendicular holes, it can also be accessorized into a spindle sander or mortising machine.

Jointer and Planer: These two tools will quickly pay for themselves as you wean yourself off of expensive, presurfaced, home-center lumber and start squaring and thicknessing rough stock.

Bandsaw: Stepping up to a bandsaw not only gives you increased control on curves, it also opens up your options for precision joinery, and the possibility of resawing.

Written by: **Lucas Peters** with **Bob Hunter**

Made in the Shade Tree Bench

With this comfy cedar bench wrapped around a tree, your backyard becomes a relaxing nature retreat. Build it in sections in your shop, and then install them easily outside.

Simple guides and spacers make quick work of cutting the angles for this tree-encircling bench. It's bound to become a favorite feature in your backyard.

Start with the seat frames

1 Rip, resaw or plane, and crosscut cedar lumber to size for the legs (A), upper rails (B), lower rails (C), and back uprights (O) [**Materials List**, *page 44*]. (For more milling instructions, see *page 28*.)

2 Lay out and drill the mortises in the legs [**Drawing 1**, **Photo A**].

3 Form tenons on the ends of the upper rails (B) and lower rails (C) [**Drawings 1**, **1a**] with a ¾" dado set on your tablesaw. Position the tablesaw fence 1¼" from the outside of the dado set, and adjust the cutting depth to ⅜". Cut the tenons in multiple passes, using a backer board to minimize chip-out.

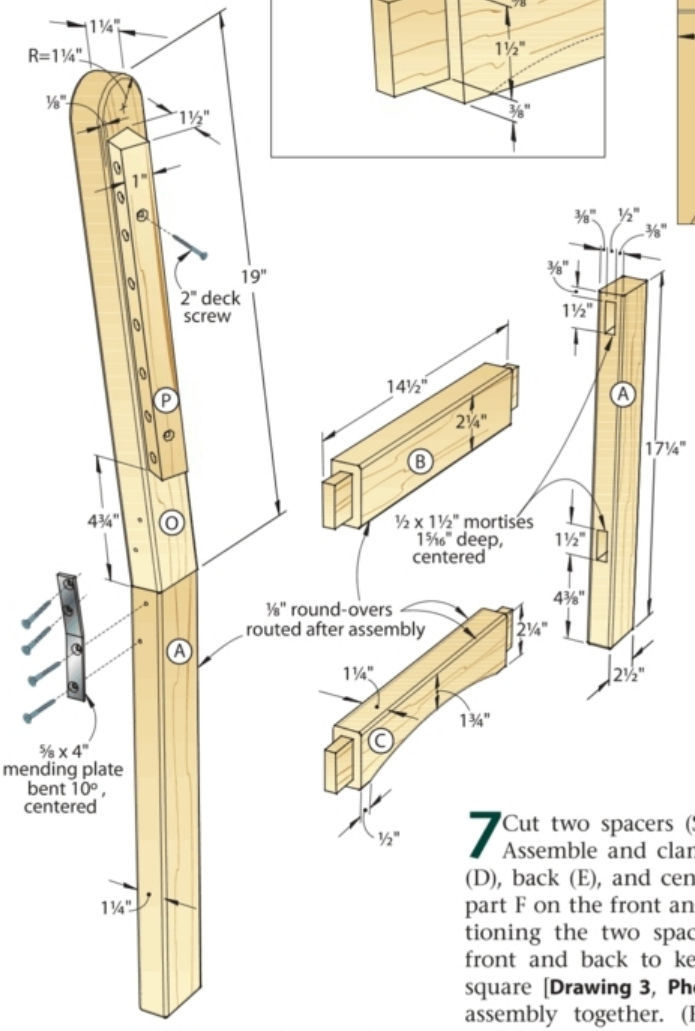
4 Lay out the curve along the bottom edge of each lower rail (C), using a fairing stick [**Drawing 1**] (see **More Resources**, *page 44*). Bandsaw or jigsaw the curve about ⅛" outside the line, and sand to the line.

5 Cut spacer SG1 [**Drawing 2**] from ½" MDF to assemble the legs (A) and rails (B, C) [**Skill Builder**]. Clamp the spacer between the rails, the edges flush with the tenon shoulders. Glue one leg to the rails; then, glue and assemble the other leg, and clamp. Repeat to make six

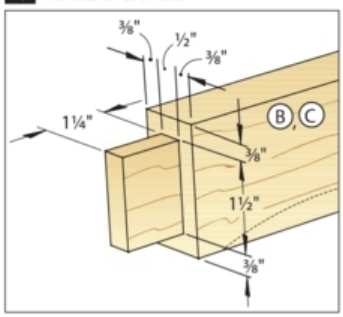
PROJECT HIGHLIGHTS

- Overall dimensions: The bench shown fits around a tree up to 20" in diameter at the base (ground level). To accommodate a larger tree, cut parts D, E, J, K, L, M, N, and Q longer; every 1" added to the length of these parts increases the permissible tree diameter by 2".
- Material needed: Cedar.
- You can build the tree bench without the seat backs by omitting parts O, P, and Q.

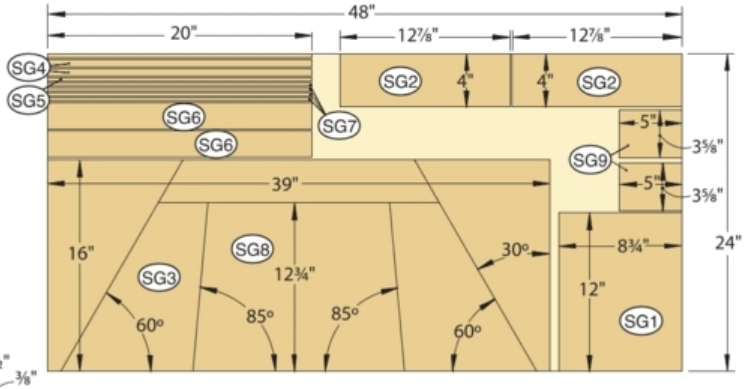
1 LEG ASSEMBLY EXPLODED VIEW

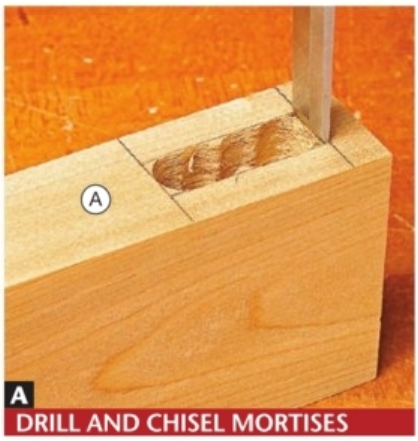


1a RAIL DETAIL



2 SPACERS AND GUIDES





A DRILL AND CHISEL MORTISES

Drill overlapping ½" holes to remove the waste from the leg (A) mortises. With a chisel, square up the ends, then clean up the sides.

leg/rail assemblies. Rout ⅛" round-overs where shown in **Drawing 3**, and sand each assembly to 150 grit.

6 Cut the frame fronts (D), backs (E), sides (G), side cleats (H), and center cleats (I) ½" longer than the dimensions given [**Materials List**, **Drawing 3**]. Cut the frame centers (F) to size. Lay out and cut the bevels on the ends of parts D and E [**Drawing 3a**]. ***Quick tip! Measure and mark just once.*** Lay out the angles on the ends of one frame front (D) and back (E). Attach an auxiliary fence to your tablesaw miter gauge, and then cut the angle at one end of one part D. Set a stopblock, and cut that end on the remaining parts D. Cut the other end, and set another stopblock to cut the remaining end on the rest. Repeat for both ends of the frame back.

7 Cut two spacers (SG2) [**Drawing 2**]. Assemble and clamp a frame front (D), back (E), and center (F), centering part F on the front and back, and positioning the two spacers between the front and back to keep the assembly square [**Drawing 3**, **Photo B**]. Screw the assembly together. (For deck screws, drill 3⁄32" pilot holes.)

8 With the D/E/F assembly still clamped together, position one of the frame sides (G) on the assembly and mark the angles on both ends. Cut to length, and then cut all frame sides to this size. Screw the frame sides to the D/E/F assembly [**Photo C**, **Drawing 3**]. Unclamp the frame. Cut the side cleats (H) and center cleats (I) to length, and glue them into place. Similarly, build the remaining frames.

9 Using a ⅜" plug cutter in your drill press, cut 36 plugs ⅜" long from scrap cedar. Glue them into the counterbores in the frame fronts. After the glue dries, trim the plugs flush with a handsaw, and sand the frames to 150 grit.

SKILL BUILDER

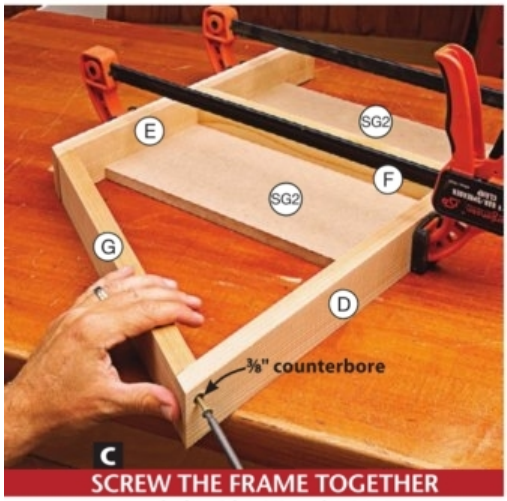
Repeat tasks easily, accurately with spacers and guides

Measuring and laying out many pieces to specific lengths and angles takes time and allows inaccuracy to creep in. Then, building matching assemblies from them can be a challenge too. Cutting guides and assembly spacers help you repeat operations accurately.

We cut all the spacers and guides for the tree bench from a 24×48" sheet of ½" MDF [**Drawing 2**]. Cut out the guides and spacers accurately, following the project instructions.

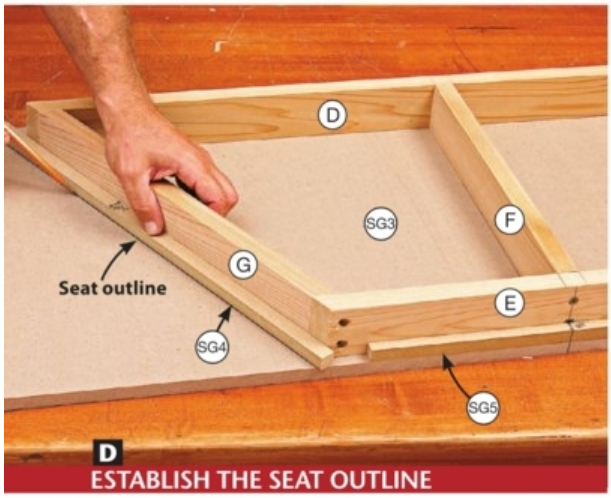
B
GET A GOOD GRIP ON ASSEMBLY

To easily screw together the H-shape D/E/F assembly, lay out the parts with spacers, clamp, and then drill holes and drive screws.



C
SCREW THE FRAME TOGETHER

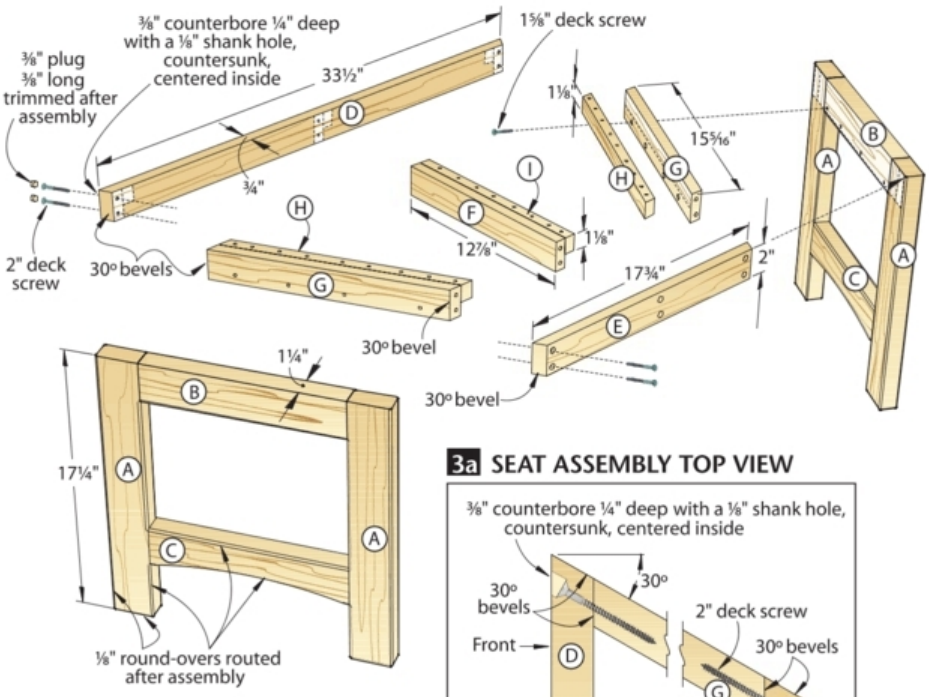
To attach the sides (G) to the D/E/F assemblies, drive the screws through the ⅜" counterbores in the frame front (D).



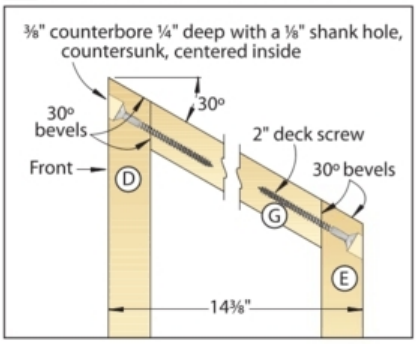
D
ESTABLISH THE SEAT OUTLINE

Place the side-overhang spacers (SG4) next to the seat frame (D–I), and trace the outline of the assembly onto the cutting-guide base (SG3).

3 SEAT ASSEMBLY



3a SEAT ASSEMBLY TOP VIEW



Add slats to the seats

1 Cut a piece of ½" MDF 16×39" for the cutting-guide base (SG3). Cut two 20" strips 9⁄16" wide for the side-overhang spacers (SG4), one strip 5⁄16" wide for the rear-overhang spacer (SG5), and two strips 1¾" wide for the saw guides (SG6) [**Drawing 2**]. Draw a centerline across the width of SG3.

2 Center the seat frame (D–I) facedown on SG3. Temporarily place the rear-overhang spacer (SG5) against the frame back (E), flush with the edge of the sheet, and a side-overhang spacer (SG4) against each frame side (G). Then, draw the seat outline on SG3 along the outside of each side spacer [**Photo D**]. Remove the seat frame and spacers.

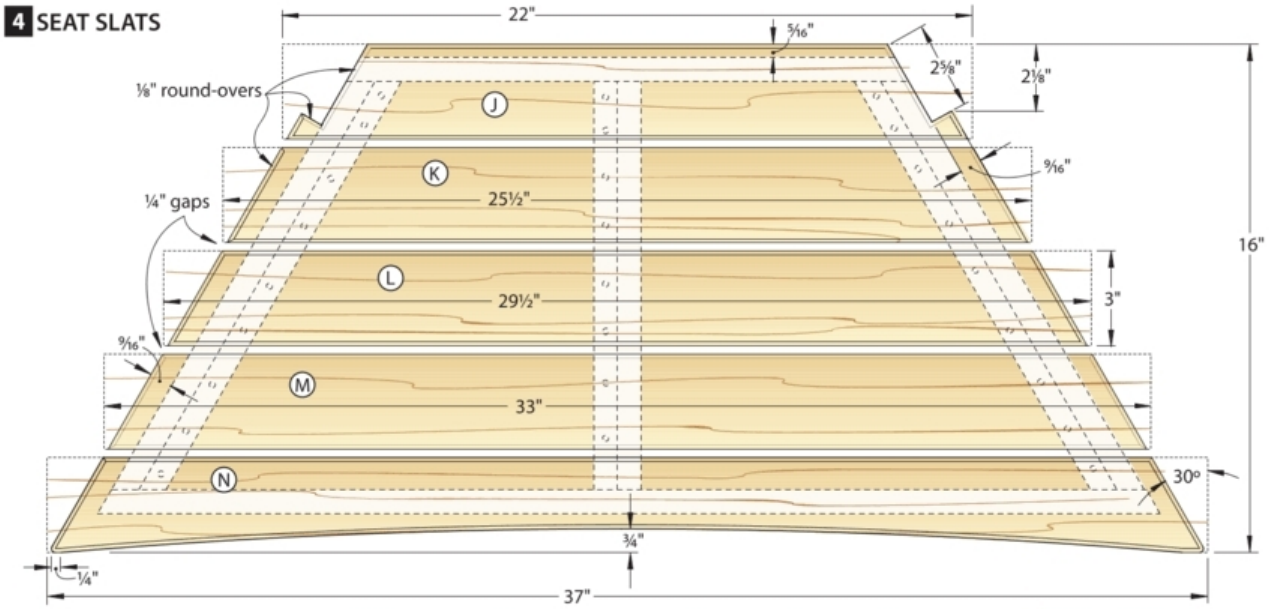
3 Measure the distance between the back of your circular-saw blade and the edge of the baseplate farthest from it. Mark that distance from the seat outline toward the center of SG3, and draw a line parallel to each seat outline. Attach the saw guides (SG6) to SG3 on those lines so the saw will cut along the seat outlines [**Photo E**]. With your circular saw, trim both ends of SG3 to the seat outlines to complete the cutting guide.

4 Cut the seat slats (J–N) to size. Also, cut four ¼"-wide MDF strips (SG7) [**Drawing 2**], and crosscut them into 12 spacers for laying out the seat slats.

5 Stand two scrap 2×4 risers about 30" long on edge in a V formation on your workbench. Arrange the seat slats (J–N) on the risers in order, and insert ¼" spacers (SG7) between them. Clamp the cutting guide (SG3/SG6) to the slats, and trim both ends of the slats with your circular saw [**Photo F**]. Trim the slats for the other five seats.

6 (***Note:*** *Omit this step if you are building the tree bench without seat backs.*) Lay out the notches on the back edge of the slats (J) [**Drawing 4**]. Cut them with a handsaw, jigsaw, or bandsaw.

7 Lay out the curved edges on the front slats (N) with a fairing stick, and cut them with a jigsaw or bandsaw [**Drawing 4**]. Rout ⅛" round-overs on the



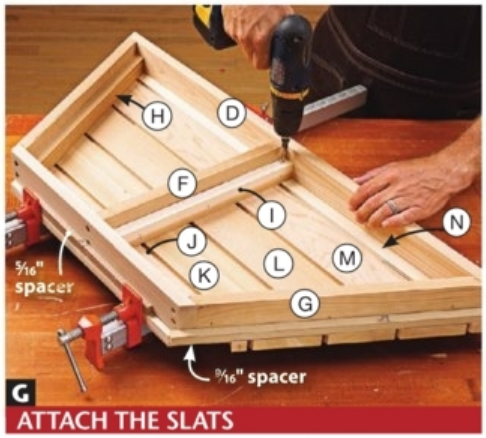
top edges of all slats, and the front bottom edge of the front slat. Sand the slats to 150 grit.

8 Lay two bar clamps on your bench about 15" apart, with the jaws facing up. Position one of each of the seat slats (J–N) face-down in the clamps, with ¼" spacers (SG7) between the slats over the clamp bars. Clamp the slats and spacers together, aligning the angled ends with a straightedge. Lay a frame (D–I) upside down on the slats, and position it using the 5/16" spacer at the back and the 9/16" spacers along the sides [**Photo G**]. Attach the slats with screws through the cleats (H, I). Repeat this operation to assemble the remaining five frames.

9 To make on-site installation easier later, glue and screw two leg assemblies (A–C) to one seat assembly (D–N), and one leg assembly to the right side (facing the front) of another seat assembly [**Drawing 3, Photo H**]. Join these assemblies to make a double-seat bench section. Make two of these, leaving two seat assemblies without legs attached.

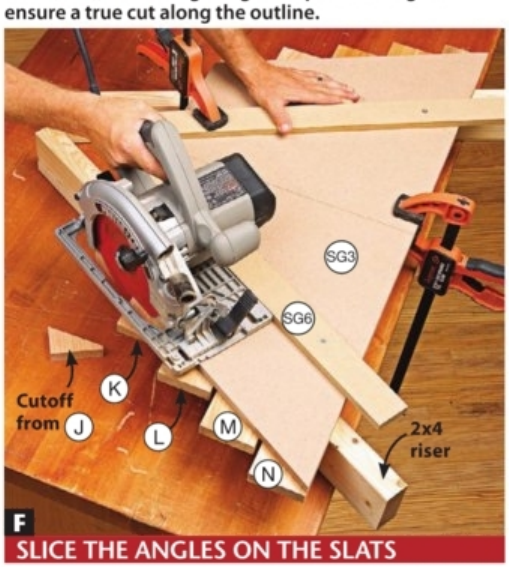
GUIDE YOUR CIRCULAR SAW

Screw the saw guides (SG6) to the cutting-guide base (SG3), extending the guides past the edges to ensure a true cut along the outline.



ATTACH THE SLATS

Predrill screw holes to prevent splitting the cleats (H, I) or slats (J–N) when you attach the slats to the seat frames.



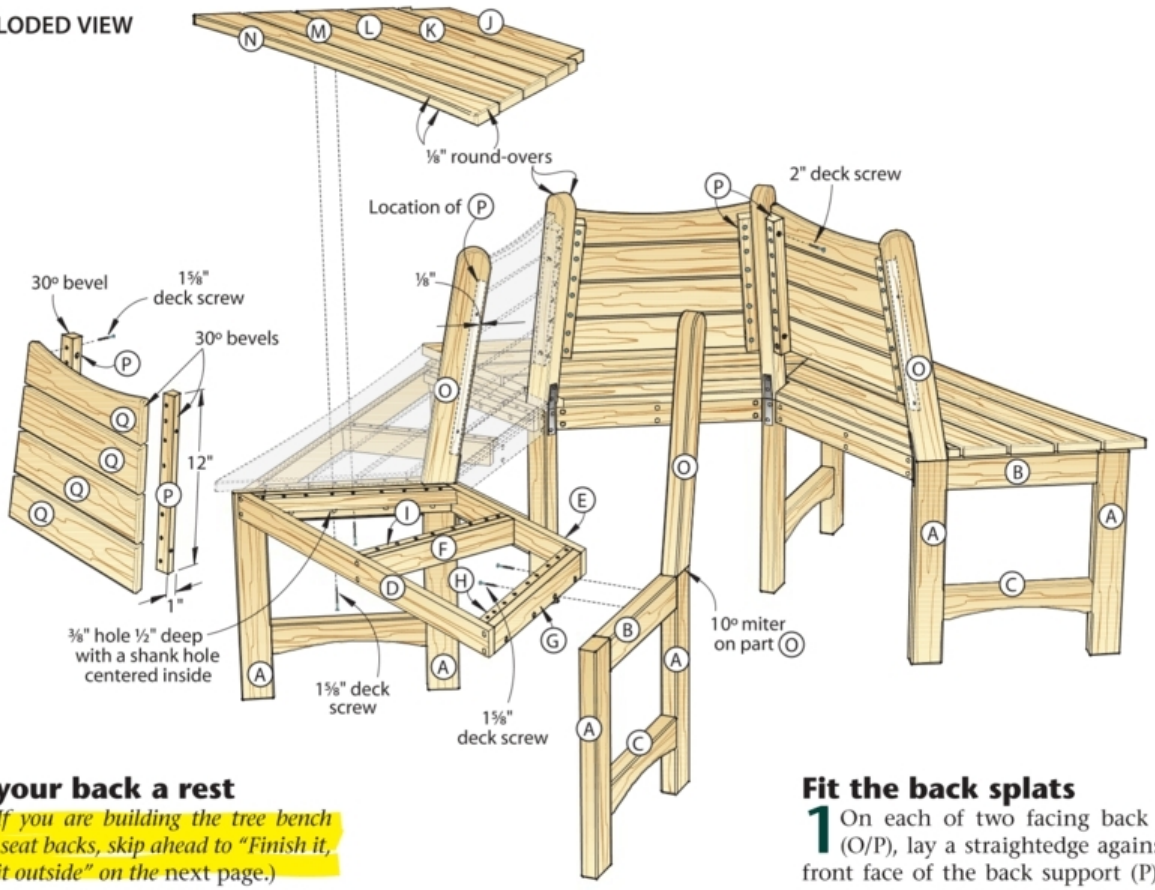
SLICE THE ANGLES ON THE SLATS

Center the cutting guide (SG3/SG6) on the slats and clamp securely. Place the back of the guide flush with the front edge of slat (N).

ADD LEGS TO THE SEAT

Glue and clamp the leg assembly (A–C) to the frame side (G) first. Angle the screws so your drill/driver will clear the frame center (F).

5 EXPLODED VIEW



Give your back a rest

(***Note:*** *If you are building the tree bench without seat backs, skip ahead to "Finish it, and set it outside" on the* next page.)

1 Lay out and cut the radius at the top of each back upright (O) [**Drawing 1**]. ***Quick tip! Sidestep tedious layouts with a template.*** Instead of measuring and laying out the shape on six blanks, draw it out on just one. Bandsaw or jigsaw slightly outside the line, and sand to the line. Place this upright on each of the remaining uprights and trace around it. Miter-cut the bottom of each upright to 10° [**Drawing 5**]. Cut a piece of scrap material to 10° on one end also. (You'll use the scrap later when bending the mending plates that attach the uprights to the legs [A]). Rout round-overs on the front, back, and top edges of the uprights, but not on the bottom. Sand the uprights to 150 grit.

2 Cut the back supports (P) to size, and bevel-rip one edge of each at 30° [**Drawing 5**].

3 Glue and screw back supports (P) to both sides of two back uprights (O), locating them 4¾" from the bottom and ⅛" from the back [**Drawings 1**, **6a**]. Glue and screw one support on the right side of each of two more uprights, and one on the left side of each of the other two uprights. Set aside the remaining four back supports.

4 Attach the back posts (O/P) to the bench assemblies (A–N) with screws and ⅝×4" steel mending plates bent to a 10° angle [**Drawing 1**, **Shop Tip**]. Predrill the screw holes. Mount a post with two supports in the middle of each double bench section. Then, on each end of the double bench, attach an upright that has one support on the side facing in [**Drawing 5**].

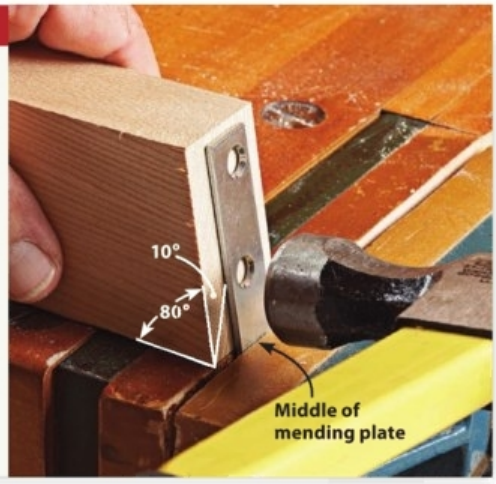
Fit the back splats

1 On each of two facing back posts (O/P), lay a straightedge against the front face of the back support (P), and mark a point on each upright (O) ½" below the support. Measure between the two uprights at those points, and subtract ¼". The resulting measurement is the back-side length of the lower back splat (Q) [**Drawing 6**]. Next, measure 12¾" up from the point on each upright, along the front face of part P, and draw another mark. Measure between these points and subtract ¼" to find the back-side length of the upper back splat.

SHOP TIP

Bend steel with your not-quite-bare hands

To bend the thick steel mending plates for the tree bench, grip the steel plate in a vise. Place the line where you want the steel to bend along the top of the vise jaws. Then, bend the top back by striking it just above the vise jaws with a hammer. Hitting too high on the plate will bend it in the wrong place. As you work, gauge the angle with scrapwood cut to 10°.



I

BUILD A BEVEL GUIDE

The narrow part of the saw base rides on the cutting-guide base when you make the jig and cut the back splats; hold the saw firmly.

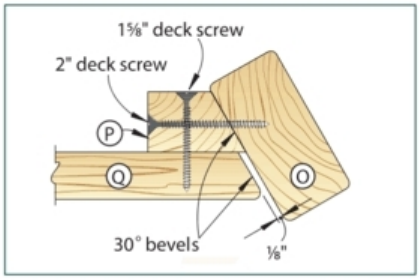
BIG SPLAT AT THE BOTTOM

Center the lower back splat (Q) between the uprights (O), and clamp it to the back supports (P). Then, drill and drive in screws.

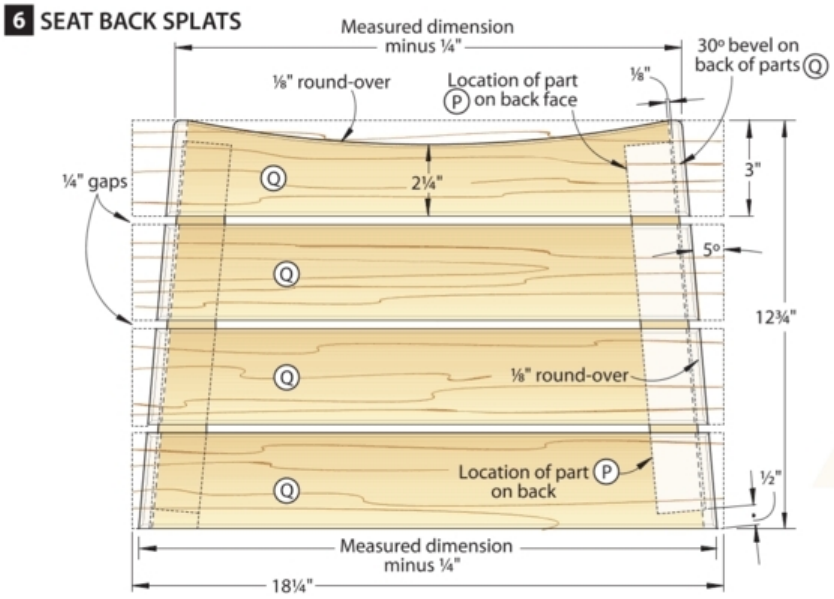
2 Remove the saw guides (SG6) from the cutting-guide base (SG3), and rip the base to 12¾" wide to make cutting-guide base SG8 [**Drawing 2**]. Mark the ends of the upper back splat (Q) back-side length centered along one edge. Mark the ends of the lower back splat back-side length centered along the other edge. On the edges of SG8, lay out inward-sloping 30° lines from the marked points [**Photo I**]. Where the angled lines meet the opposite face of SG8, draw cutting lines connecting the two edges. Lay the cutting-guide base on risers on your bench with the cutting lines facing up. Tilt your circular saw to a 30° bevel angle, and attach the saw guides (SG6) to cut bevels along the lines on both ends of the cutting guide.

3 Cut the back splat blanks (Q) to size. As you did for the seat slats, lay four splats facedown on bench risers with ¼" spacers between them. Place the cutting guide (SG6/SG8) on the splats, and clamp securely. Then, cut the beveled ends of the back splats with the circular saw set for a 30° bevel cut. Repeat for the other five sets of splats.

6a SEAT BACK SPLATS TOP VIEW



6 SEAT BACK SPLATS



4 Lay out, cut, and sand the curves on the top edges of the six upper back splats (Q) [**Drawing 6**]. Rout round-overs on the long edges of all 24 splats, and sand them on the beveled ends. Sand all back splats to 150 grit.

5 Cut two spacers (SG9) [**Drawing 2**]. Stand them on edge on the seat beside the uprights (O), and position the lower back splat (Q) on them. Screw the splat in place [**Photo J**, **Drawing 6a**]. Lay a ¼" spacer on the installed splat, and attach the next one up, continuing this process to the top of the backrest. Install splats on the four attached backs in the same manner.

6 Screw the remaining splats (Q) to the unattached back supports (P), spacing them ¼" apart. Place the splat ends ⅛" back from the beveled edge of the support on the long face [**Drawing 6a**] and ½" below the bottom edge of the back support [**Drawing 6**].

Finish it, and set it outside

1 Touch up the sanding as necessary, and apply an exterior finish. We used Behr Semi-Transparent Deck, Fence & Siding Wood Stain, Cedartone color, no. 3-533. We applied the stain with a garden sprayer, following the manufacturer's instructions.

2 After the stain dries, take the two double-bench assemblies (A–Q), the two seat assemblies (D–N), and the two back support/splat assemblies (P/Q) to the installation site.

3 Set the double-bench assemblies (A–Q) on opposite sides of the tree. Clamp the two seat assemblies (D–N) in place between them temporarily (see **More Resources**, *page 44*). Center the tree trunk in the opening.

4 Level the bench by digging soil from under some legs with a trowel or setting pavers under some [**Photo K**]. For the most solid setting, place pavers under all the legs. Placing pavers can help minimize damage to tree roots near the surface by reducing digging, too.

5 When the bench is sitting solid and level, make reference marks on the bench and tree to indicate position. (Tape or surveyor's flagging will suffice.) Unclamp and remove the two seat assemblies (D–N), then remove the double-bench assemblies (A–Q).

K
SOON IT WILL BE SITTIN' PRETTY

Dig or shim under the legs to level the bench. Paver blocks set in sand or gravel paver base under the legs minimize shifting and settling.

L
FINISH UP WITH THE BACKREST

Predrill screw holes through the supports (P) into the uprights (O), and drive screws to attach the back assembly (P/Q).

6 We spread landscape fabric over the area to create a bed slightly larger than the diameter of the bench. Install edging, if you wish.

7 Replace the double-bench assemblies (A–Q) and seat assemblies (D–N) in their original positions. Attach the seats to the benches.

8 Install the two back support/splat assemblies (P/Q). Place the spacers (SG9) on the bench seat, and center the back assembly on them between the uprights (O). Attach the back [**Photo L**]. Repeat for the other back assembly.

9 Add plants if you wish. Then, spread mulch or ground cover on the landscape fabric. Now, grab your favorite outdoor beverage, plop down on your new bench, and relax.

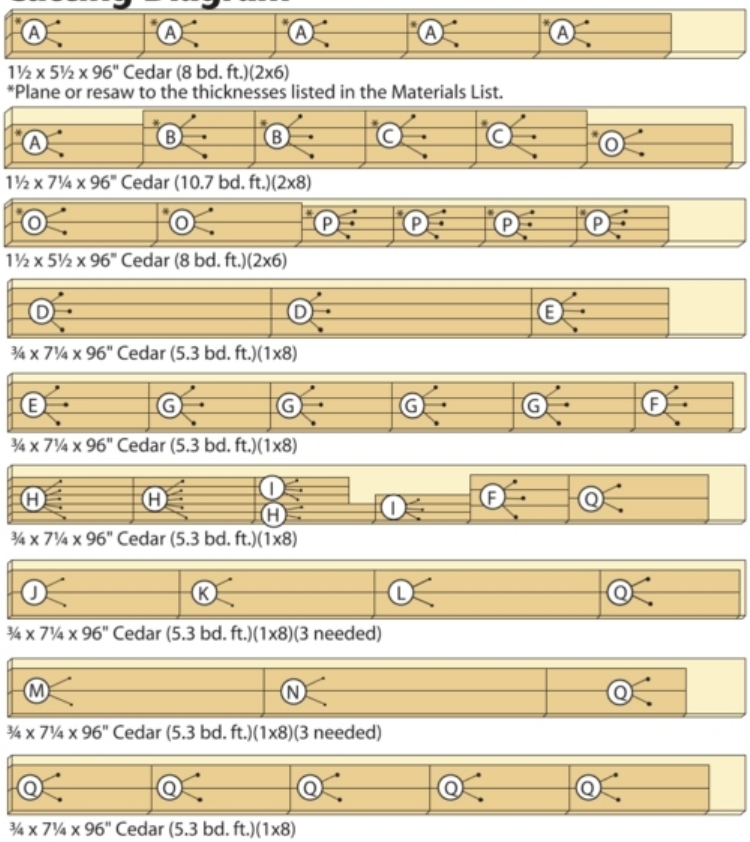
Written by **Larry Johnston** with **Jeff Mertz**
Project design: **Kevin Boyle**
Illustrations: **Roxanne LeMoine; Lorna Johnson**

MORE RESOURCES

FREE VIDEOS

- Making and using a fairing stick at woodmagazine.com/fairingvideo
- Installing the tree bench at woodmagazine.com/treebench

Cutting Diagram



Materials List

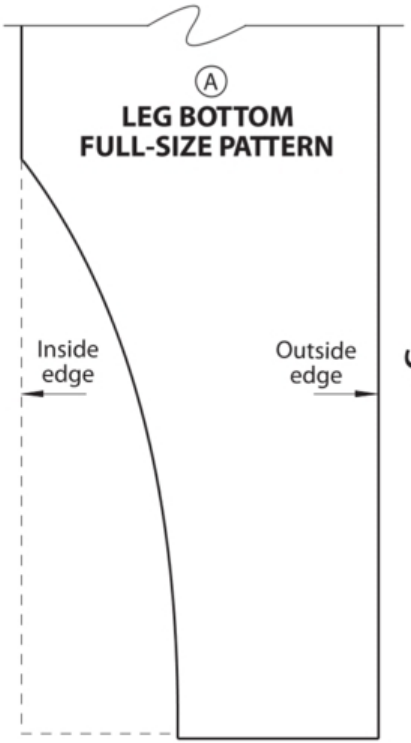
Part		FINISHED SIZE T	W	L	Matl.	Qty.
Leg assemblies						
A	legs	1¼"	2½"	17¼"	C	12
B	upper rails	1¼"	2¼"	14½"	C	6
C	lower rails	1¼"	2¼"	14½"	C	6
Frames						
D*	frame fronts	¾"	2"	33½"	C	6
E*	frame backs	¾"	2"	17¾"	C	6
F	frame centers	¾"	2"	12⅞"	C	6
G*	frame sides	¾"	2"	15⅝"	C	12
Seats						
H*	side cleats	¾"	1⅛"	15⅝"	C	12
I*	center cleats	¾"	1⅛"	12⅞"	C	6
J	seat slats	¾"	3"	22"	C	6
K	seat slats	¾"	3"	25½"	C	6
L	seat slats	¾"	3"	29½"	C	6
M	seat slats	¾"	3"	33"	C	6
N	seat slats	¾"	3"	37"	C	6
Backs						
O	back uprights	1¼"	2½"	19"	C	6
P	back supports	1"	1½"	12"	C	12
Q*	back splat blanks	¾"	3"	18¼"	C	24

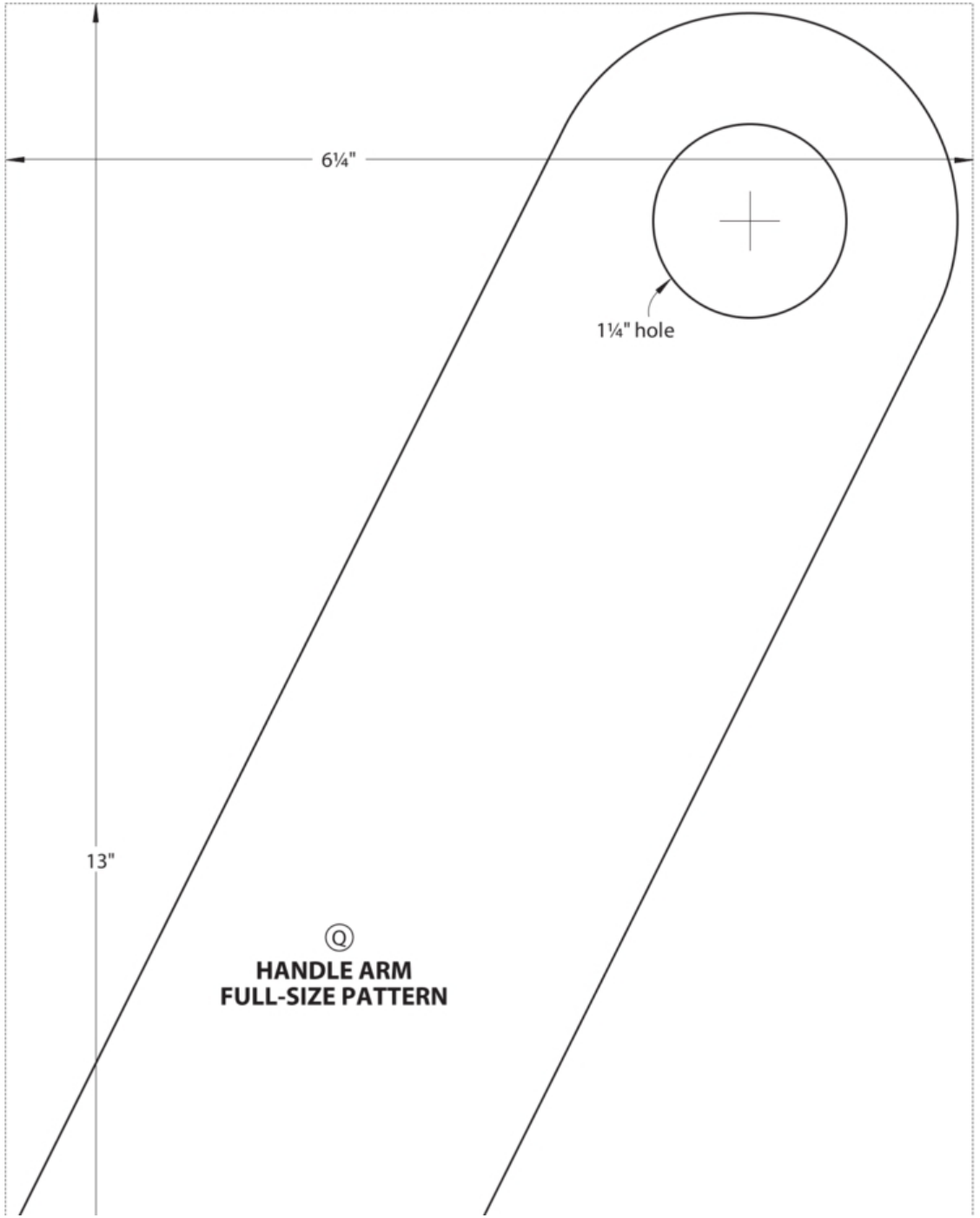
*Parts initially cut oversize. See the instructions.

Material key: C–cedar.
Supplies: 1⅝" and 2" deck screws; ⅝×4" steel mending plates.
Blade and bit: Stack dado set, ⅛" round-over router bit, ⅜" plug cutter.

Telephone Stand
Page 62

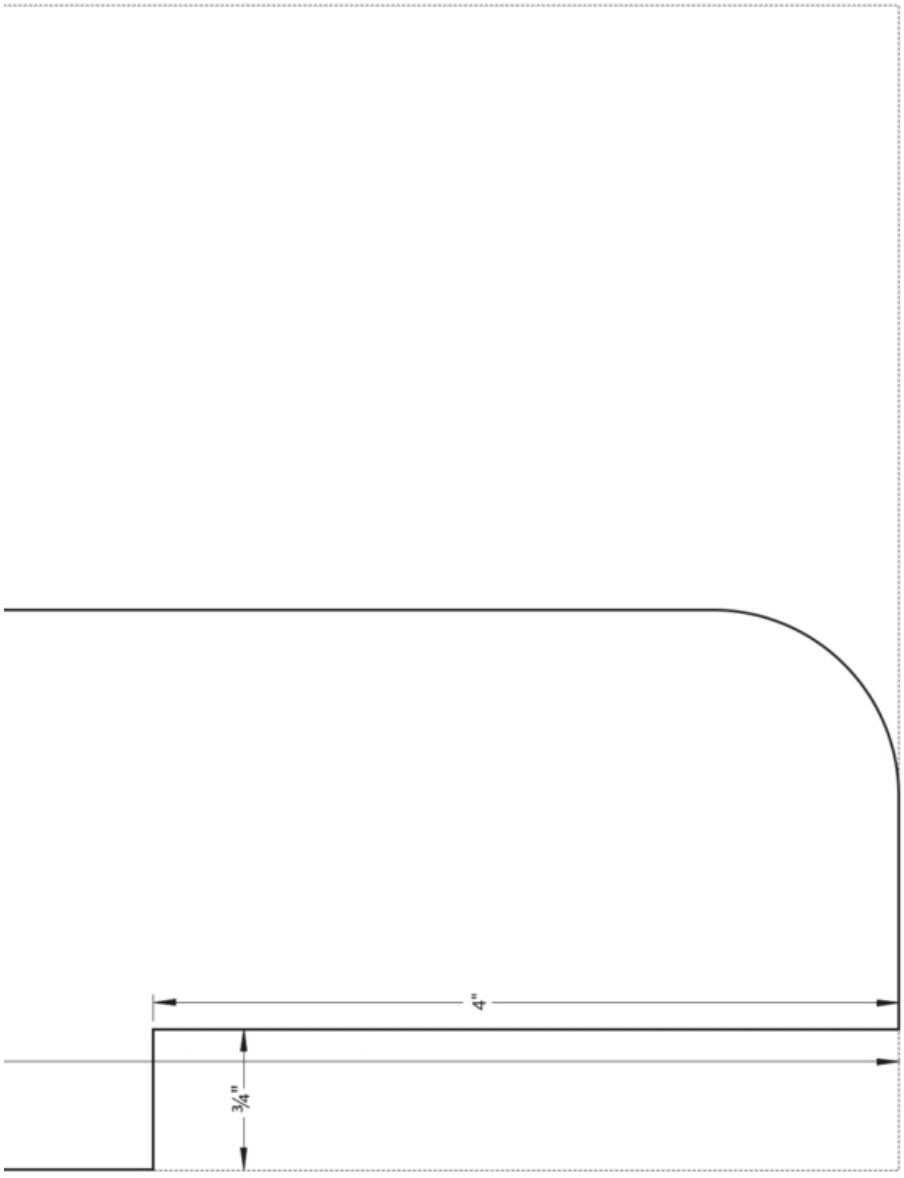
Ⓐ
LEG BOTTOM
FULL-SIZE PATTERN



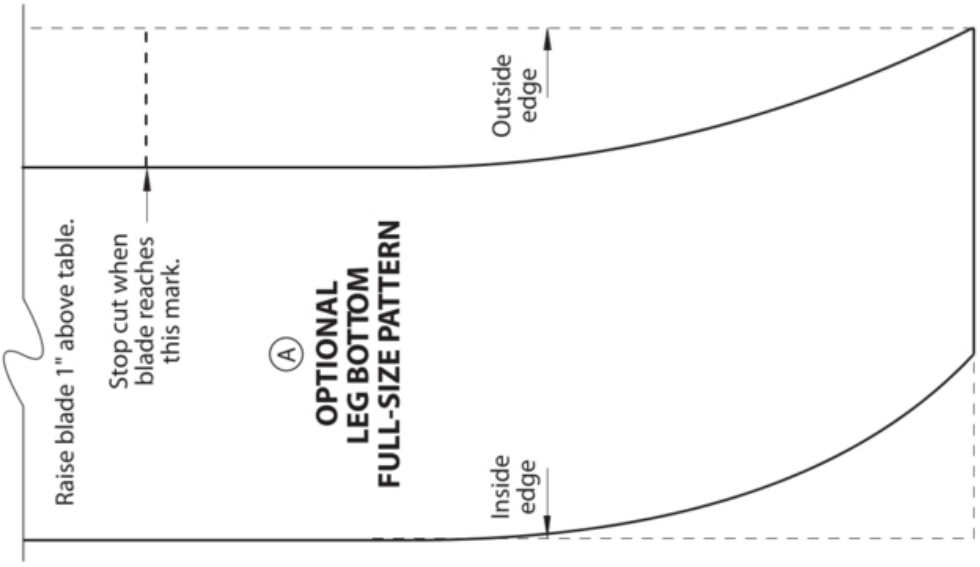


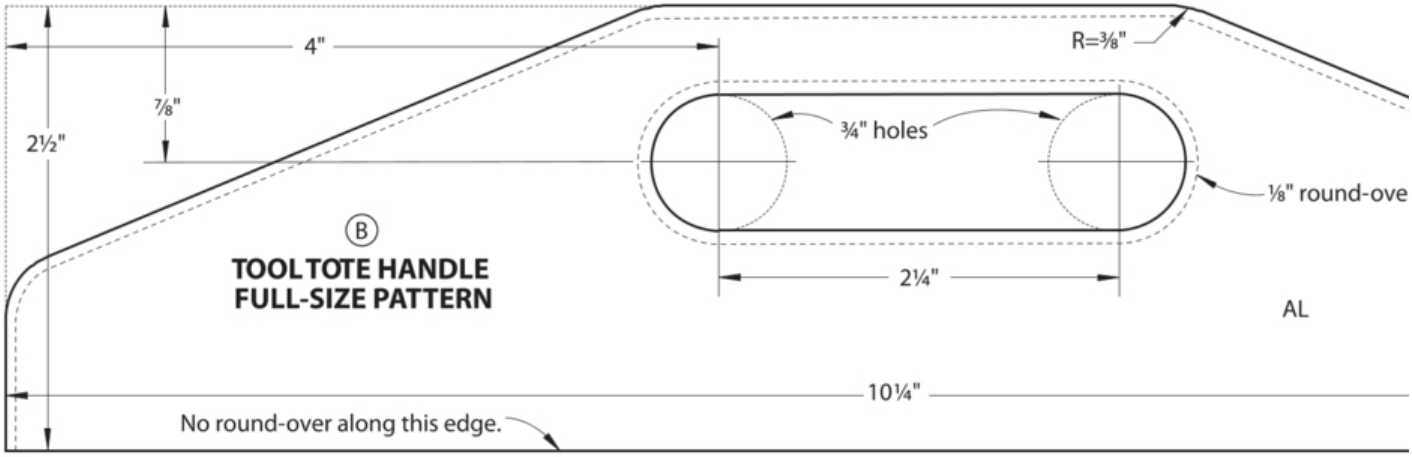
Ⓠ
HANDLE ARM
FULL-SIZE PATTERN

Air-Compressor Caddy
Page 52

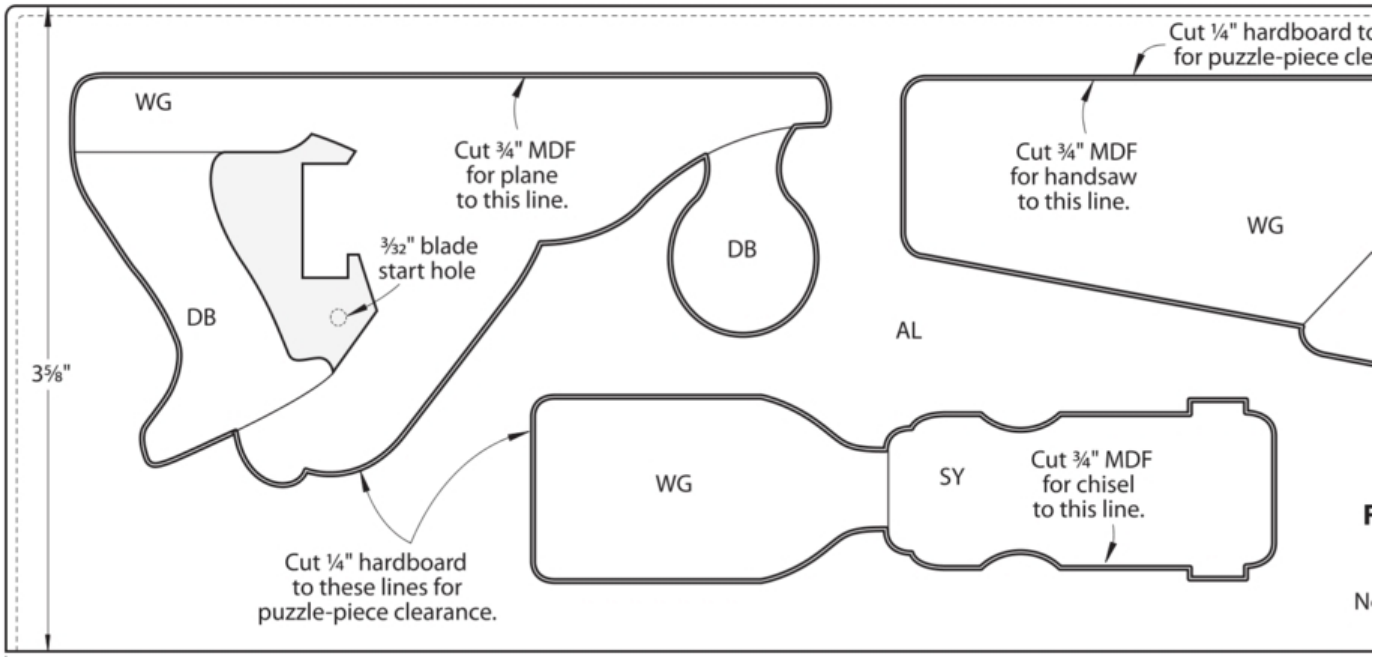


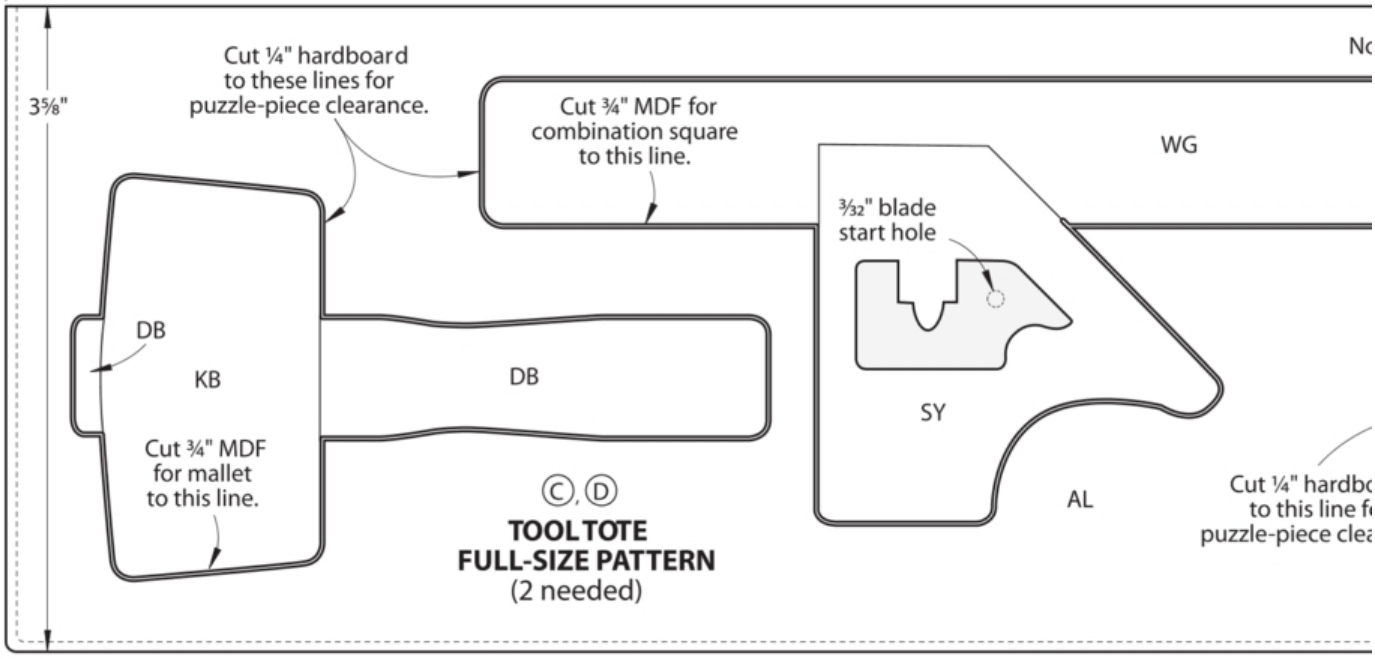
Telephone Stand Optional Leg
Page 65





Ⓑ
TOOL TOTE HANDLE FULL-SIZE PATTERN





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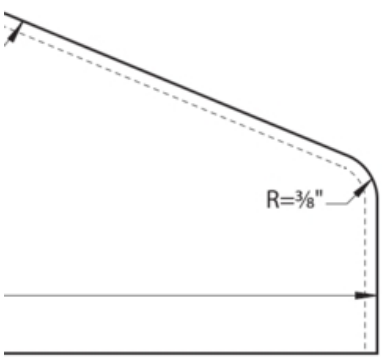
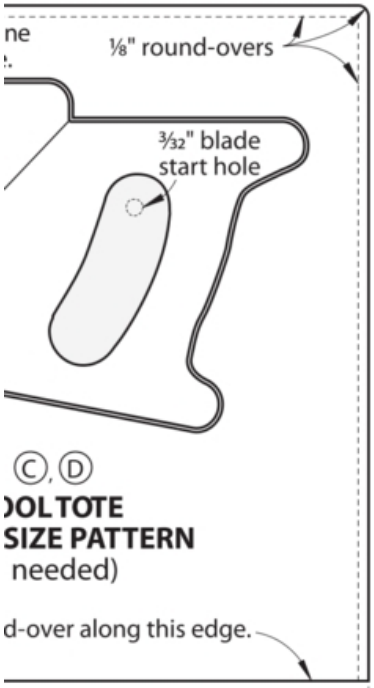
TOOL TOTE FULL-SIZE PATTERN
(2 needed)





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SIZE PATTERN
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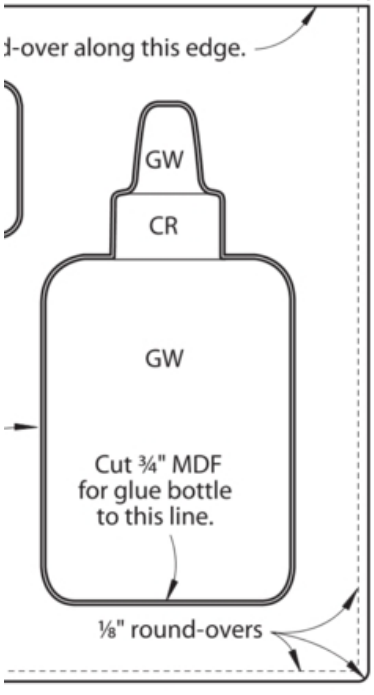

Better Homes and Gardens®
WOOD® PATTERNS®
May 2009 *Issue 190*

Dear Reader: As a service to you, we've included full-size patterns on this insert for irregular shaped and intricate project parts. You can machine all other project parts using the Materials List and the drawings accompanying the project you're building.

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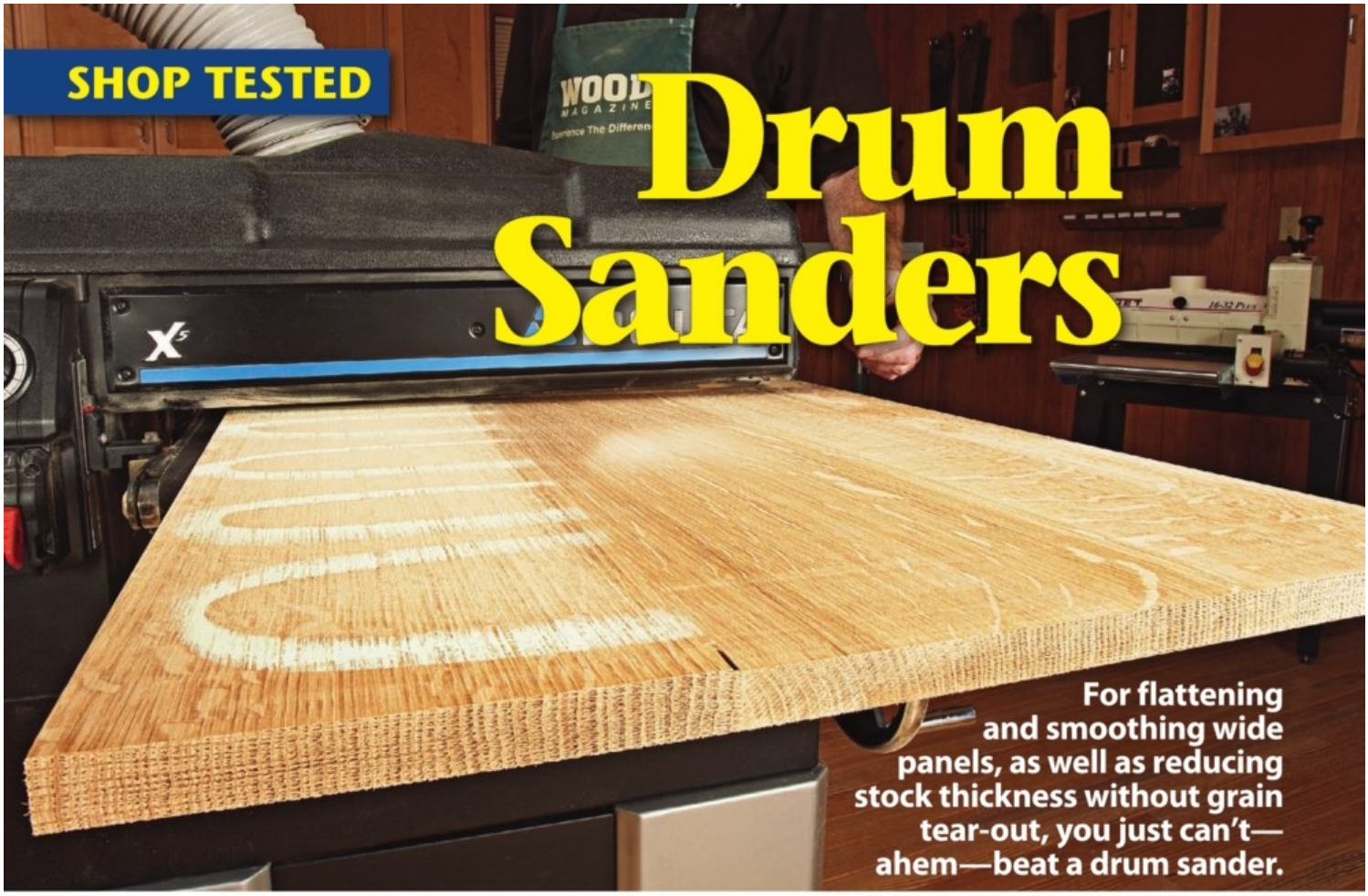
Kids' Tool Tote
Page 76

COLOR KEY
(For Painter's Touch paints)

KB–Kona Brown, no. 1977
DB–Deep Blue, no. 1927
WG–Winter Gray, no. 1982
CR–Colonial Red, no. 1964
SY–Sun Yellow, no. 1945
GW–Gloss White, no. 1992
AL–Almond, no. 1994

SHOP TESTED

Drum Sanders



For flattening and smoothing wide panels, as well as reducing stock thickness without grain tear-out, you just can't—ahem—beat a drum sander.

Although considered a luxury item by many, a drum sander proves invaluable for working with wide panels or figured wood. But that's not all. Trust us: Once you get a drum sander, you'll find yourself using it on virtually every project. To help you decide if a drum sander is right for you, and which one to buy, we tested five models priced under $1,200—two closed machines that handle stock up to 12" wide, and three open-ended units that sand twice as wide as their 10–18" drums.

Find the drum sander that fits your work

Closed-ended machines, such as Grizzly's G0459 and its near-twin Shop Fox W1740, shown on the *page 51*, can't sand anything wider than 12". But the fixed bearing mounts on each end of the drum make it nearly impossible to deflect the drum up or down. So once set up, they should continue to turn out parallel surfaces.

On the other hand, the drums on the Delta and two Jet machines are cantilevered, leaving one end open, as shown *above*. This enables you to sand panels twice as wide as the drum simply by turning workpieces end for end after each pass. For example, the 10" drum on Jet's 10-20 Plus benchtop model can sand a panel up to nearly 20" wide. (We found in testing that we came up ⅛" to ¼" short of achieving the full width.) But over time, too-aggressive cuts can spread the open end slightly and produce panels with crowned surfaces, or the drum can sag slightly and cause gouges in the overlapped areas.

> We were rewarded with surfaces that easily finished off with light work from a random-orbit sander.

We tested each machine with various-width panels of red oak, cherry, poplar, and pine, removing up to 1/64" per pass, and found that four of the five machines deflected no more than .004" across the workpiece width anywhere along its length. Only the Shop Fox showed deflection up to .008", but that's still a negligible amount. (Each unit has adjustments to restore parallel alignment should it become an issue.)

As important as accuracy, the finished surfaces produced by these machines impressed us. We were rewarded with surfaces easily finished with light work

Drum sanders hand an assist to planers

Although you can use both machines to reduce the thickness of any workpiece, a drum sander won't replace a thickness planer. A planer removes stock much more quickly, but often tears out chunks from workpieces, particularly around knots, grain switches, and figured wood. This proves more likely with dull planer knives.

That won't happen with a drum sander. It uses a powered conveyor belt to feed stock at variable rates. Pressure rollers hold the workpiece down while an abrasive-wrapped drum sands away material—in increments of 1/64" or less for best results. Naturally, coarser sanding belts remove material faster than finer grits, which are used to eliminate scratches from the coarse grits.

from a random-orbit sander. We got the best finishes with feed rates of 6 feet per minute (fpm) or less.

We also pushed each machine to find its minimum workpiece capacities. The two Jet sanders will sand stock as short as 2¼" and as thin as 1/16". The Grizzly and Shop Fox models will handle stock as short as 8" and as thin as 5/64". The Delta worked on 6"-long stock but could not sand stock thinner than ⅛" without it secured to a carrier board.

Other things we learned

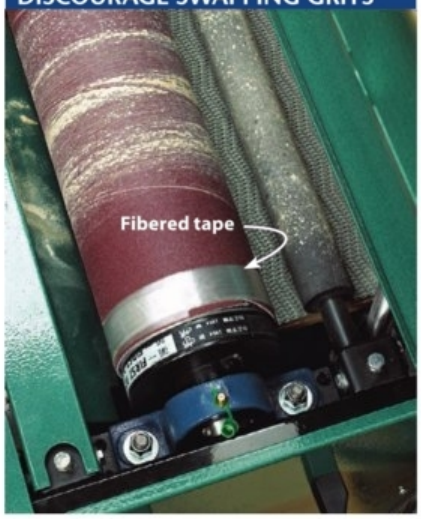
■ **Wrapping gets tedious.** Ideally, changing sanding belts would be as easy as swapping blades on a tablesaw. But it's not. With all five machines, you wrap narrow abrasive belts with tapered ends around the drums. The Grizzly, shown at *right*, and Shop Fox units use hook-and-loop–backed belts that grip the drum and prove easy to change. With the remaining models, you secure one belt end in a spring clip inside the drum, then wrap the belt tightly, and finally clasp the other end in another clip, shown *center* and *bottom*. Operating the clips can be clumsy, even with the provided tool on the Jet models, and it takes some trial and error to find the right starting points on each belt.

■ **You still need power.** Using a new 60-grit belt, we found we could remove 3/64" from a 12"-wide workpiece at a 6-fpm feed speed on all five machines (although that cut exceeds the manufacturers' recommendations). And with finer grits that cutting depth dropped off. Delta and both Jets earned extra credit for exceeding even those aggressive cuts without bogging down.

■ **Support proves helpful.** None of the sanders comes with infeed and outfeed tables to support long workpieces, but Jet's optional tables work well. Unlike the Jets, which have fixed tables and drums that adjust up and down, the others have fixed drums and movable tables. Not only do those manufacturers not sell infeed and outfeed tables, but this setup makes it nearly impossible to attach shop-made supports.

■ **Avoid dust clouds.** These sanders produce so much fine dust, it's critical to have good dust collection. Jet's 4" port centered along the drum did the best job of evacuating dust in our tests; Delta's off-center 4" port tended to leave more dust behind. The 2½" ports on the Grizzly and Shop Fox struggled to corral the dust with either a shop vacuum or a dust collector hooked up.

FINICKY BELT CHANGES MIGHT DISCOURAGE SWAPPING GRITS



To keep the Grizzly and Shop Fox sanding belts from coming loose and flapping, wrap each end with fibered tape or duct tape.

Because the belt clips on both Jet units are difficult to access, use the provided tool to hold the clip open while you insert the belt.

Delta's drum also has spring-loaded clips, but they're easier to access than the Jet sanders' because you can get more fingers on them.

Delta 31-260X, $1,100

800-223-7278, deltaportercable.com

With the largest workpiece capacities in the test—nearly 36" wide and 4" thick—this 18"-wide drum sander proved robust and stable. It has two drum speeds (2,210 fpm for most work and 3,300 for fine-grit finishing), but changing the belt to switch speeds was more trouble than it was worth. A third hand would help to hold the drum steady when installing sanding belts because it takes both hands to operate the spring clips and insert the belt ends. And we could see the belt slipping on the drive roller when the drum began to bog down. Bottom line: A good performer for a premium price.

BRAND	MODEL	SANDING DRUM SPEED, FPM	SANDING DRUM MAX. WORKPIECE WIDTH, INCHES	SANDING DRUM ABRASIVE TYPE (1)
DELTA	**31-260X**	2,210/3,300	35⅝	C
GRIZZLY	**G0459**	2,300	12	H
JET	**10-20 PLUS**	2,225	19⅝	C
	16-32 PLUS	2,250	31⅝	C
SHOP FOX	**W1740**	2,300	12	H

1. (C) Cloth-backed
   (H) Hook-and-loop
2. (S) Sandpaper
   (R) Rubber
3. * Length increases to 36" with optional infeed/outfeed tables
   ** Length increases to 42½" with optional infeed/outfeed tables

Grizzly G0459, $575

800-523-4777, grizzly.com

Shop Fox W1740, $695

800-840-8420, shopfox.biz

Essentially identical (except for cosmetic touches), these models feature easy-to-install low-cost hook-and-loop sanding belts (both added 180 and 220 grit rolls to their lineups after our test), and tacky rubber feed belts that grip workpieces securely without scratching. They thickness stock up to 12" wide accurately and shouldn't need adjustment. Fine threads on the height-adjustment handwheels deliver the best microadjustability, but it takes twice as many turns to equal the others when making coarse adjustments. The 2½" dust port chokes down dust collection.

Jet 16-32 Plus, $1,050

800-274-6848, jettools.com

Although pricey, this model features SandSmart, a control that automatically slows the feed rate when the sanding drum begins to bog down on a workpiece. As a result, we got equally fine finishes at all speeds. Like its smaller sibling, the 16-32 Plus sands shorter and thinner stock than its competition, and can still work to nearly 32" wide. It has the same difficulties with installing belts as the 10-20 Plus, and replacement belts cost around $8.25 each.

Jet 10-20 Plus, $700

800-274-6848, jettools.com

The lightest unit in the test, the 10-20 Plus works well on a benchtop and stores easily when not in use. Its 10" drum sands panels nearly 20" wide and also sands the shortest and thinnest stock with accuracy and fine finish. The height-adjustment wheel showed almost no backlash, and the scale was among the easiest to read. Still, replacement sanding belts cost about $8 apiece, and they're clumsy to install, even with the provided tool. When sanding at 2 fpm or slower, the feed-belt motor pulsed erratically, leaving scalloped marks on the workpiece.

Our recommendation

Although changing abrasives proved finicky, Jet's 16-32 Plus showed enough dominance in the most important areas to separate itself from the pack, earning Top Tool honors. The Top Value award goes to the Jet 10-20 Plus. At $700, it's not the least expensive unit, but its 20"-width capacity and ability to handle small or thin stock give it an edge.

Written by **Bob Hunter** with **Doug Hicks**

DRUM SANDERS: 5 SMOOTH OPERATORS GO HEAD-TO-HEAD

	FEED BELT									PERFORMANCE GRADES (6)											ACCESSORIES (7)							
										PRIMARY					SECONDARY													
	MATERIAL (2)	SPEED RANGE, FPM	OVERALL DIMENSIONS HxWxL, INCHES (3)	HEIGHT-ADJUSTMENT TYPE (4)	PRESSURE-ROLLER MATERIAL (5)	MINIMUM WORKPIECE LENGTH, INCHES	MAXIMUM WORKPIECE THICKNESS, INCHES	HEIGHT ADJUSTMENT PER REV., INCHES	DUST-PORT DIAMETER, INCHES	THICKNESSING ACCURACY	QUALITY OF FINISHED SURFACES	OBSERVED POWER	EASE OF CHANGING SANDING BELTS	DUST COLLECTION	EASE OF ADJUSTING THICKNESS	EASE OF ELIMINATING SNIPE	ACCURACY OF SCALES	EASE OF TENSIONING FEED BELT	EASE OF TRACKING FEED BELT	STANDARD	OPTIONAL	REPLACEMENT SANDING BELT PRICE	WEIGHT, LBS.	CORD LENGTH, FEET	WARRANTY, YEARS	COUNTRY OF ASSEMBLY (8)	SELLING PRICE (9)
	S	0–12	47×34½×24	B	S	6	4	1/16	4	A	A	A-	C+	B	a-	a-	b	a	a-	B,S		$6.25	190	6	5	C	$1,100
	R	1–15	26½×27×24	B	R	8	3½	1/32	2½	A	B+	B	B+	C	b-	b	c	b-	b	B	S	$3.30	149	11.5	1	T	575
	S	0–12	20×24½×17½ *	D	S	2¼	3	1/16	4	A	A	A-	C	A	b+	b	a-	b	b-	B,W	C,S,T	$8.00	96	6	5	T	700
	S	0–10	19×33×24¼ **	D	S	2¼	3	1/16	4	A	A	A	C	A	b+	b	a-	b	b-	B,S,W	C,T	$8.25	164	6	5	T	1,050
	R	1–15	26½×27×24	B	R	8	3½	1/32	2½	A-	B+	B	B+	C	b-	b	c	b-	b	B	S	$3.75	149	11.5	2	T	695

4. (B) Feed belt raises and lowers; drum height is fixed
   (D) Drum raises and lowers; feed-belt height is fixed

5. (R) Rubber-coated steel
   (S) Steel

6. A Excellent
   B Good
   C Fair

7. (B) Sanding belts
   (C) Casters for stand
   (S) Stand
   (T) Infeed/outfeed tables
   (W) Belt-installation wrench

8. (C) China
   (T) Taiwan

9. Prices current at time of article production and do not include shipping, where applicable.

SHOP PROJECT

Compressed-Air

Build this caddy from one sheet of plywood and a few dimensional lumber scraps. It holds a small compressor, hose, nailers, fasteners, and other accessories in one ready-to-roll unit.

PROJECT HIGHLIGHTS

- Overall dimensions: 27¾" deep × 26¾" wide × 42" high.
- This cart accommodates most pancake- and hot-dog-style air compressors.
- You'll find everything needed to build it at local stores.

If you're tired of tripping over air hoses, lugging around an air compressor, or digging through cabinets for a nailer, here's a hassle-saving, easy-to-build project. All it takes: a few hours of your time and about $75 in materials.

Don't have an air compressor? This project also works well as a garden cart. If you plan to leave it outside, though, be sure to use exterior-grade materials.

Work Station

First, build the case

1 Cut the sides (A) to size [**Materials List**, *page 55*], and lay out the contoured front edge [**Drawing 1**]. Using a bandsaw or jigsaw, cut 1/16" outside the line, and then sand to the line. ***Quick tip! Stack-cut the sides for a perfect match.*** Lay out the contour on only one side, and stack the sides with edges flush, fastening them together with double-faced tape. Then, cut the contour.

2 Cut a ½×½" axle notch in the sides (A) [**Drawing 1**]. Separate the sides.

3 Rout ⅛" round-overs on both faces along the front edges [**Drawing 2**].

4 Cut the bottom (B), back (C), and shelves (D) to size. (Sand individual components throughout the project, particularly on the interior faces, to 150 grit before assembly.)

5 Assemble the sides (A), bottom (B), back (C), and bottom shelf (D) [**Drawing 2, Photo A**] using glue and screws. (Drill 7/64" pilot holes for the #8 screws in this project.)

Construct the accessory compartments

1 Cut the vertical divider (E) and middle large shelf (F) to size. Glue and screw the middle large shelf (F) to the divider (E), centered along its width [**Drawing 2**].

2 Cut the middle small shelf (G) to size [**Drawing 2**]. *NOTE: The width of this shelf, combined with the length of the middle large shelf (F) and the thickness of the vertical divider (E), should equal the length of the shelf (D).*

3 Glue the middle small shelf (G) to the divider (E), directly opposite the middle large shelf (F) [**Drawing 2**].

4 Cut three top shelf dividers (H) to size, and then glue and screw them to the unattached top shelf (D). Align a divider flush with each end, and center the third [**Drawing 2**].

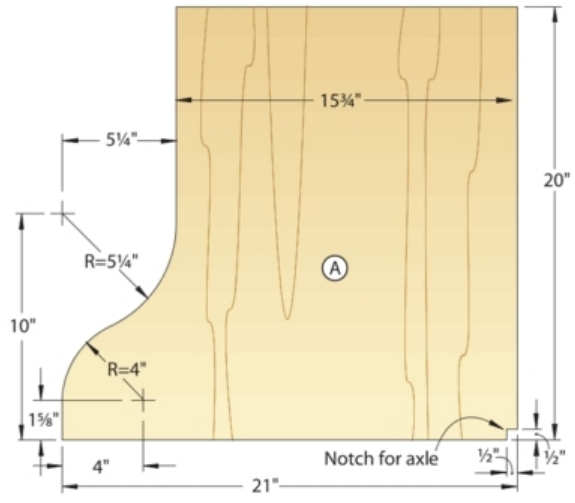
5 Glue and screw the top shelf assembly (D, H) to the top of the vertical divider (E). Attach this assembly to the shelf (D) mounted on top of the carcase and the back (C) [**Drawing 2, Photo B**] with the back edges flush. The assembly should sit ¾" (or your plywood's thickness) from the front edge of the sides (A); the front will rest on that ledge.

SUPER-SIMPLE CARCASE JOINERY

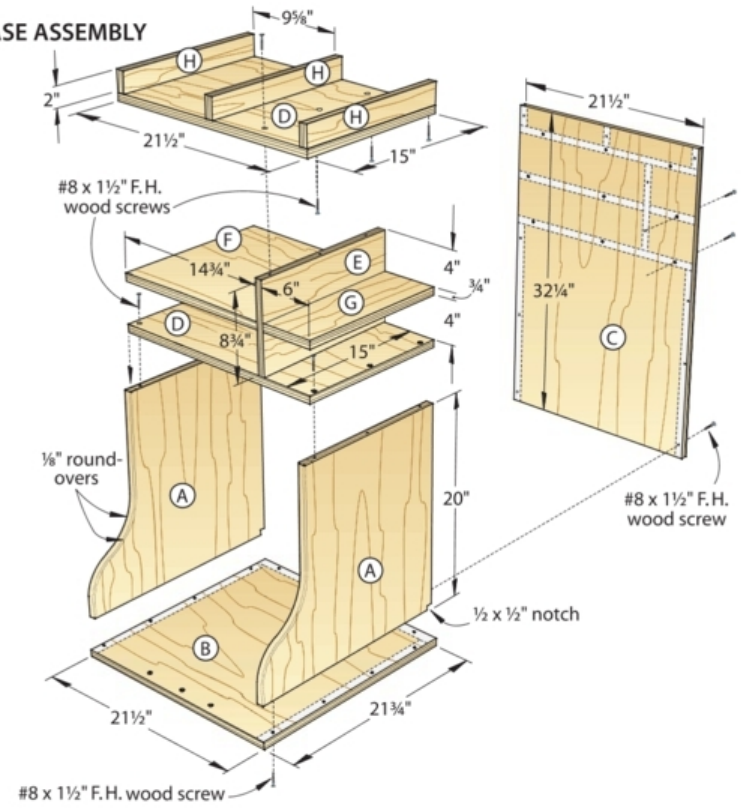
Use clamps to hold the case assembly together while you secure it with glue and wood screws.

6 From 36" solid stock, make four side shelf trim blanks (I). ***Quick tip! Go long, then short.*** To avoid routing thin, narrow stock on your router table, instead rout the ⅛" round-overs along two edges of a pair of strip blanks, then rip and crosscut to final size. Glue the side shelf trim (I) to the shelves (D, F, G), flush with the outer shelf edges [**Drawing 3**].

1 SIDE LAYOUT DETAIL



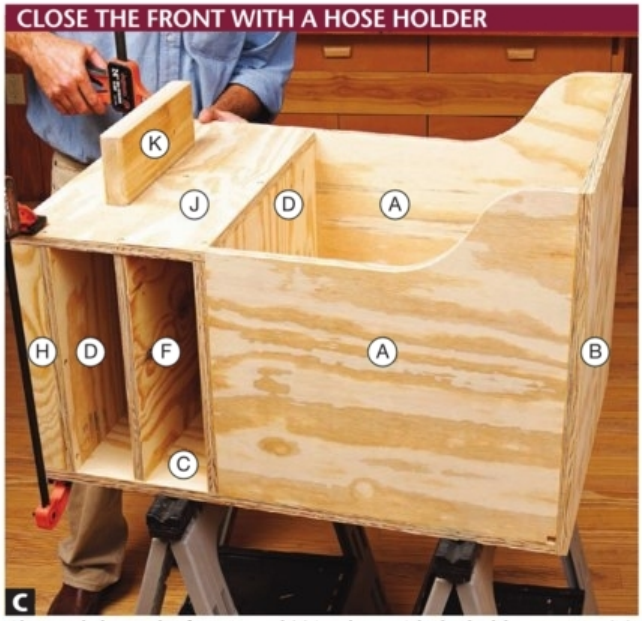
2 CASE ASSEMBLY



ADD SHELVES FOR NAILERS

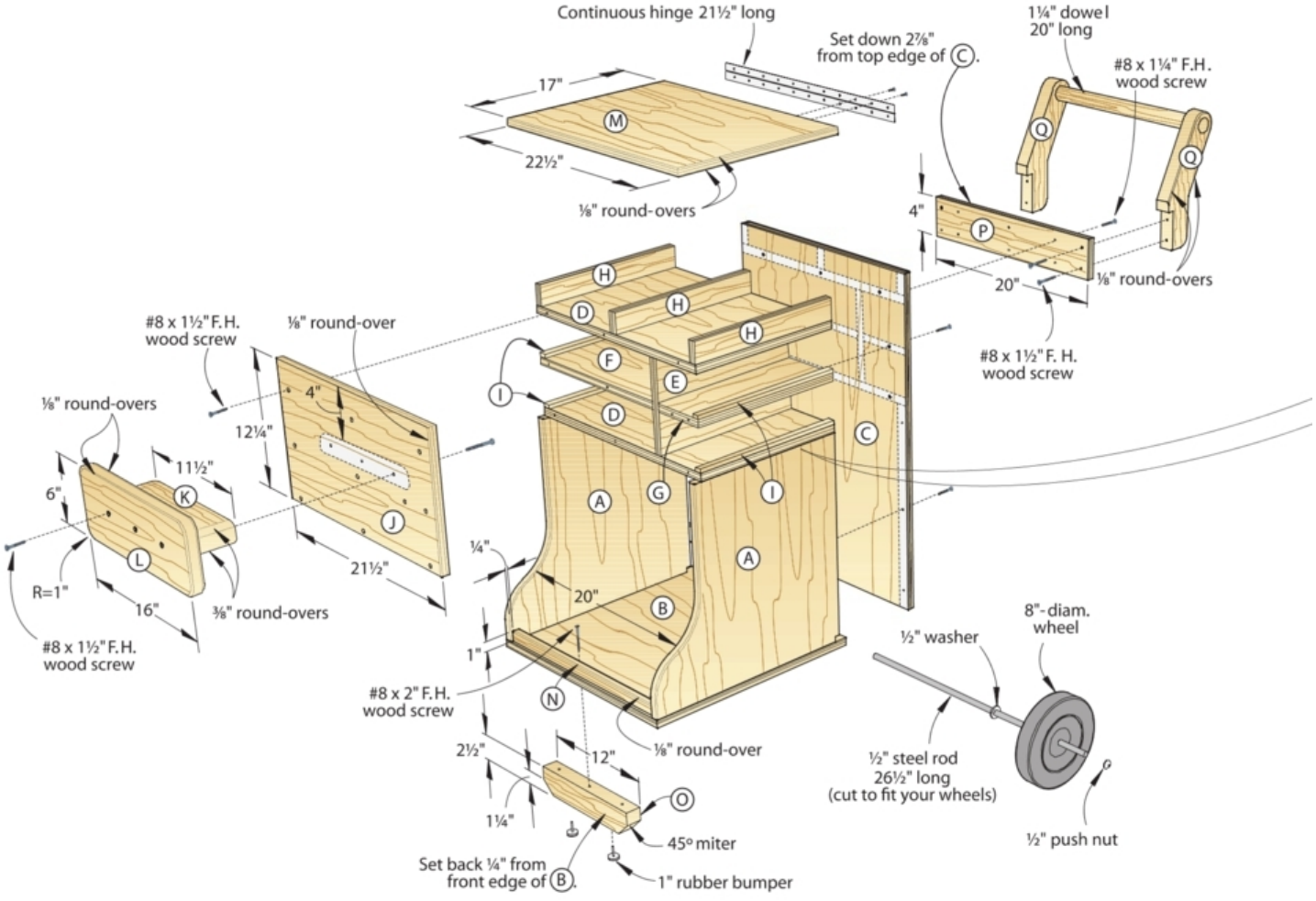
After gluing the compartment assembly in place, drive screws through the bottom of the shelf and back.

CLOSE THE FRONT WITH A HOSE HOLDER



Glue and clamp the front panel (J) in place with the holder support (K) closer to the top of the case. Use screws to secure it.

3 EXPLODED VIEW



Make the case front and air-hose holder

1 Cut the front panel (J) and holder support (K) to size. Rout a ⅜" round-over on the ends of the holder support.

2 Glue and screw the holder support (K) to the front panel (J), centered across its width 4" from the top edge.

3 Attach the J/K assembly to the front of the case (A–I) with glue and screws [**Drawing 3, Photo C**].

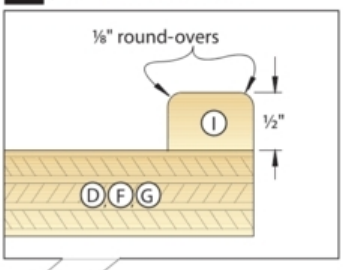
4 Cut the hose holder (L) to size, with a 1" radius on each corner. Rout the edges and ends with a ⅛" round-over bit. Center and attach the hose holder to the holder support (K) with glue and screws [**Drawing 3**].

Add top & bottom details

1 Cut the lid (M) to size, and then rout ⅛" round-overs on the ends and front edge—but not the back edge.

2 Center and mount a 21½"-long continuous hinge (cut from a 24" hinge) to the back edge of the lid (M) with the provided screws [**Drawing 3**].

3a SHELF TRIM DETAIL



3 Place the lid (M) onto the caddy, centered side-to-side and flush with the back (C). Attach the hinge to the back [**Drawing 3**].

4 Cut the foot (O) to size and machine a 45° miter on each end 1¼" from the bottom edge.

5 Glue and screw the foot (O) to the bottom of the case, centered side-to-side and set back ¼" from the front edge. Screw two 1"-diameter rubber bumpers to the bottom of the foot.

6 Cut the bottom trim (N) to size from the remaining blanks made earlier. Glue this piece to the bottom (B), set back ¼" from the front edge [**Drawing 3**].

Nothing's more handy than a handle

1 Cut the handle support (P) to size from ¾" plywood.

2 Cut two blanks for the handle arms (Q) from 2×8 stock. Tape them together for stack-cutting on a bandsaw, and adhere the Handle Arm Full-Size Pattern (found in the *WOOD Patterns*® insert on *page 46*) to the blanks with spray adhesive. (If you're using a jigsaw, make two copies of the pattern and cut each blank separately.) Cut to within 1/16" of the line, and then sand the edges smooth.

3 Drill the 1¼" hole through both handle arms (Q) where shown on the pattern. Remove the pattern and separate the pieces.

4 Glue and screw the handle arms (Q) to the handle support (P) [**Drawing 3**].

5 Glue and screw the P/Q handle assembly to the back (C) of the cart, centered side-to-side and 2⅞" from the top edge of the back.

6 Insert a 1¼"-diameter dowel into the holes of the handle arms (Q), mark it flush with the arms, and cut it to length. Glue the dowel into the holes.

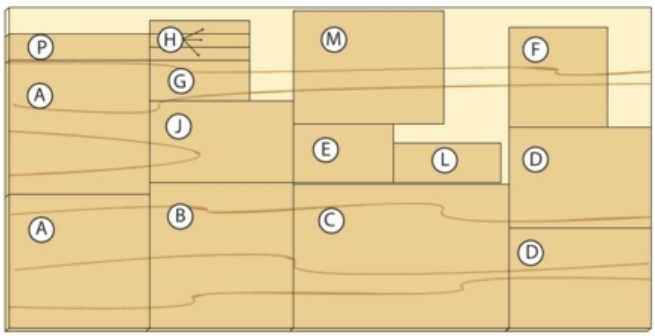
Add finish and hardware

1 Sand the cart to 150 grit, and then apply two coats of clear finish to seal the wood.

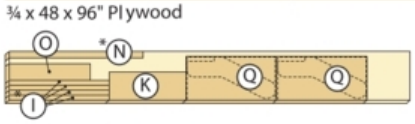
2 Using a hacksaw, cut the ½"-diameter steel rod to length so you can get a wheel, flat washer, and a push nut on each end. The fit should be snug so the wheels turn easily but won't move side-to-side. Remove any burrs or sharp edges with a file. Insert the rod into the cart and install the wheels, washers, and push nuts.

Written by **Bob Hunter** with **Doug Hicks**
Project design: **Kevin Boyle**
Illustrations: **Roxanne LeMoine; Lorna Johnson**

Cutting Diagram



¾ x 48 x 96" Plywood



1½ x 7¼ x 60" Pine (6.7 bd.ft.)(2x8)
*Plane or resaw to the thicknesses listed in the Materials List.

Materials List

Part		FINISHED SIZE T	W	L	Matl.	Qty.
A	sides	¾"	21"	20"	PL	2
B	bottom	¾"	21¾"	21½"	PL	1
C	back	¾"	21½"	32¼"	PL	1
D	shelves	¾"	15"	21½"	PL	2
E	vertical divider	¾"	8¾"	15"	PL	1
F	middle large shelf	¾"	15"	14¾"	PL	1
G	middle small shelf	¾"	6"	15"	PL	1
H	top shelf dividers	¾"	2"	15"	PL	3
I*	side shelf trim	¾"	½"	15"	P	4
J	front panel	¾"	12¼"	21½"	PL	1
K	holder support	1½"	4¼"	11½"	P	1
L	hose holder	¾"	6"	16"	PL	1
M	lid	¾"	17"	22½"	PL	1
N*	bottom trim	¾"	1"	20"	P	1
O	foot	1½"	2½"	12"	P	1
P	handle support	¾"	4"	20"	PL	1
Q*	handle arms	1½"	6¼"	13"	P	2

*Parts initially cut oversize. See the instructions.

Materials key: PL–plywood, P–solid pine.
Supplies: Double-faced tape, spray adhesive, #8×1¼" flathead wood screws, #8×1½" flathead wood screws, #8×2" flathead wood screws, 1½" continuous hinge 21½" long, 1¼" diameter dowel, 1" diameter rubber bumpers (2), ½" steel rod 36" long, ½" flat washers (2), ½" push nuts (2), 1¾×8" rubber wheels (2).
Blades and Bits: ⅛" and ⅜" round-over router bits.

A Simple System for Classic Casework

Today's techniques and tools make old-time craftsmanship easier than ever to achieve.

If you typically build furniture with sheet-goods carcasses, it's hard to imagine a world before plywood and MDF. There was one, though, filled with sturdy, lightweight furniture made of framed panels. Such assemblies shrink or swell with the seasons without splitting or their joints pulling apart. Other frame-and-panel furniture advantages still hold true today:

- The technique offers design flexibility. For example, by extending the frame

stiles 2" below the rails on each side panel for a project, such as the one *opposite*, you raise the height of your nightstand or end table. Or make the stiles square and longer, and you've created legs for an end table.

■ Even when using plywood panels, frame-and-panel furniture weighs less than comparable cases made from ¾" plywood or MDF with hardwood trim or a frame attached.

■ The frame-and-panel technique works as well for fine-furniture projects, such as the mission-style nightstand illustrated *opposite*, as it does for the pine-and-perforated-panel tool stand shown at *right*.

■ Solid wood frames hide plywood edges, so you can skip the face frame or edge banding.

To help you create your own frame-and-panel furniture, we'll look at the elements that make this technique work: panels; frame joinery; frame widths; carcase-assembly tips; and methods for installing tops, bottoms, and backs.

A frame-and-panel back and sides make up this tool stand.

Produce the perfect panel

Panels do more than just fill the space between stiles and rails. Structurally, they help keep the frame from racking. They also contribute to a project's style, whether with a raised profile or with their grain pattern.

For best appearance, panels should be taller than they are wide for a vertical look. You can do that even on horizontal projects using center stiles between the panels, as shown on the chest at *right*. Here are three common panel types.

FLAT PANELS: SIMPLICITY ITSELF

Flat panels give furniture a clean, simple look. You can create flat panels from solid wood, but veneered plywood costs less (and its edges will be hidden by the frame). Where both sides of a panel will be visible, glue together two sheets of ⅛"-thick veneered plywood to make a panel with two good sides.

PROS: Veneered plywood panels require no special tools, bits, or joinery to create. Plywood expands less than solid wood, so gluing it into the frame adds strength. Also, it's faster because you don't need to edge-glue and flatten a solid-wood panel. Other panel options include perforated hardboard, glass, or acrylic sheets.

CONS: Because most ¼" plywood measures about 1/16" thinner than that, as shown *above*, cutting frame grooves tight enough to hold the panel firmly requires trial-and-error fitting.

RAISED PANELS ADD CONTOURS

Add dimension and shape to your frame-and-panel furniture with raised panels. To form the profile, use a panel-raising bit to rout ¾"-thick solid-wood panels. Profile options include ogees, coves, rounded bevels, and chamfered Shaker styles. To avoid tear-out and burns, rout the ends first and then the edges in multiple shallow passes. If you'll paint the panel, use MDF to save money.

PROS: Raised panels add shadow lines. Rail-and-stile and panel-raising bit combinations let you customize the look. Unlike back-cut raised panels *above right*, you can vary the edge thickness to fit wider frame grooves or use stock slightly thinner than ¾".

CONS: Gluing up solid wood for panels adds time and steps to a project. Specialty router bits cost more than cutting sheets on a tablesaw.

BACK-CUT FOR FLUSH PANELS

As back-cutting panel-raising bits shape a profile on the front face, another cutter removes material from the back to leave a ¼"-thick tongue in most cases. Unlike the raised panel with a flat back *above left*, the faces of these panels rest flush with the frame faces.

PROS: The flush back looks more attractive where that face is visible. The bit automatically determines a consistent panel-tongue thickness cut after cut, even when you vary the profile slightly. The back-cutter adds little to the price over a comparable bit without a cutter.

CONS: Controlling the edge thickness requires adjusting the shims that come with most bits. This profile works best on solid-wood panels. Removing both faces of an MDF panel eliminates most of its strength. These bits lack a bearing necessary for cutting arch-top panels.

Frame joints vary by strength and style

Now it's time to choose a frame joint that both suits your project style and stands up to stress. For furniture that's moved frequently or roughly, join frame parts with haunched-mortise-and-tenons or dowels rather than cope-and-stick joints. You'll also need heavy-duty joints for frames holding panels made of heavy materials, such as MDF.

STUB-TENON-AND-GROOVE JOINTS

You could make these on a router table, but they're easier on a tablesaw with a general-purpose blade or dado set. First cut a slightly off-center groove on one edge; then flip the stile or rail end for end and make a second cut to widen the groove. Adjust the fence and repeat to fit your panel thickness. Next, saw tenons to match the grooves.

PROS: Groove widths can be varied to suit odd plywood thicknesses. Nothing beats these joints for simplicity.

CONS: Saw blades don't always cut flat-bottom grooves. Short stub tenons have less glue joint area than regular tenons.

DOWEL JOINTS

Make these strong, simple joints with only a drill and inexpensive doweling jig. Then rout the panel grooves using a straight bit on a router table, making full-length grooves on the rails, and stopped cuts on the stiles.

PROS: Dowels reinforce easy-to-make butt-jointed corners faster than making time-consuming mortises.

CONS: Stopped grooves require extra attention to cut and square off with a chisel. Dowel holes must align exactly for tight joints and square frames. Groove width is limited by your selection of straight-bit diameters.

HAUNCHED-MORTISE-AND-TENON JOINTS

These start out much like the stub-tenon-and-groove joint *above*, but you'll extend a tenon to fit a mortise in the groove of the mating part. A tenon haunch fills the groove at the end of the mortised part.

PROS: The added tenon length and glue surface area combine for a super-strong joint that resists racking.

CONS: Cutting and hand-fitting four mortises and four tenons for each panel adds considerable work.

COPE-AND-STICK JOINTS

With a rail-and-stile bit set, shown *below right*, one bit routs the "stick" profile along one edge of each frame piece. The coping bit cuts a mating profile into the rail ends.

PROS: More than just a corner joint, this system adds a decorative profile to the rail and stile edges. Some bits stack one profile on the other, but we prefer the two-piece bit sets that let you make both cuts with the front face down.

CONS: Allow time to fine-tune the bit heights. The groove width can't narrow to accommodate thin plywood panels.

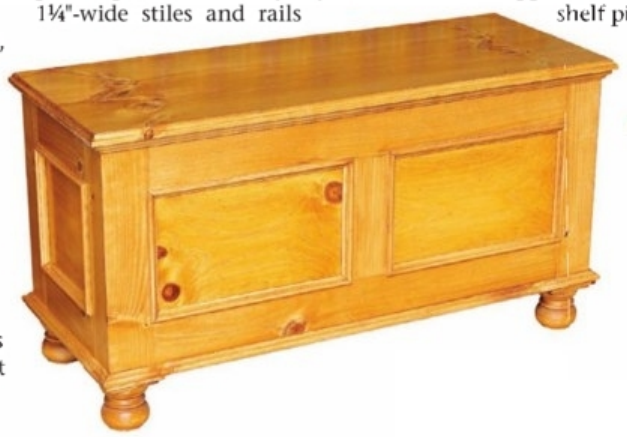
Size frame widths to suit projects

Frames for most cabinet doors measure about 2" wide, but you won't find a list of hard-and-fast rules or standards for frame-and-panel furniture.

You'll encounter a few practical limits, though. Frames members wider than 4" may create wood expansion problems. Extra-wide frames also compete with the panel for attention.

On the other hand, frame members narrower than 1" lack the width needed for strong joints, and may be pushed out of square by panel movement. And for panels much larger than a square foot, skinny frames look wimpy.

Sometimes, narrow or wide frames serve a purpose. The pine blanket chest *below* uses 3¼"-wide stiles and rails to complement its horizontal panels, simple shape, and country style. But the 1¼"-wide stiles and rails on the tabletop display case *below* allow a better view of the case contents, still support the glass panels, and accept shelf pin holes.



3 ways to connect frame-and-panel assemblies

Once you select a panel style, frame joint, and frame width, it's time to decide how you'll turn individual assemblies into a piece of furniture. This can be as simple as butting the stile edge of one frame-and-panel assembly to the stile face of another—plenty strong for projects small enough to pick up with two hands. You should attach the assemblies to a base or top for added strength.

Adding rabbets or grooves to adjoining stile edges simplifies assembly and adds strength. You can achieve similar results using stub-tenons and grooves on the stiles, as shown on the blanket chest *below center.*

And by turning stiles into legs or corner posts, as on the chest *below,* two panels share one stile. A filler covers any unfilled portion of the groove where the stile becomes a leg.

BUTTED AND ROUNDED CORNERS

1 Mitered stile edges would complement the mitered frames on this tabletop display case. But they'd also complicate its assembly. Instead, we rounded over the corners of the butted frames and matched the grains.

PROS: Butt joints go together easily with only glue. Rounded corners soften the look of the piece. They're also easy to make on individual frame pieces and the frame corners, as shown *below,* using your router table.

CONS: You'll need edge grain on one frame to blend well with the face grain of the mating frame. The butt joint can be hard to align during glue-up.

For easy, consistent rounded corners, use a ⅜" round-over bit instead of sanding to a layout line. The follower block clamped to the frame reduces tear-out.

STUB-TENONS AND GROOVES

2 To reinforce joints between butted frame-and-panel assemblies, cut a groove along one frame stile to capture the tenoned edge of the mating frame stile. The tenon lets you position the face of one frame flush or near the mating frame edge, as shown *above.*

PROS: The mechanical strength of this joint helps keep the assembled case from racking. Grooves help align the pieces during glue-up.

CONS: Cutting the grooves and tenons adds extra steps to the project. Portions of the groove not filled by the tenon will need to be covered with trim or hidden by a wooden filler piece.

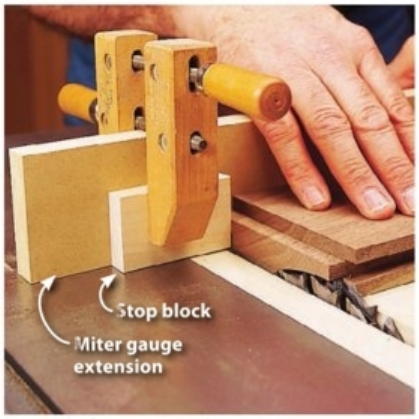
Instead of cutting dadoes, rabbets, or grooves into the separate frame parts, cut the entire frame-and-panel assembly. Attach it to a guide that rides along the rip fence.

POST STILES DOUBLE AS LEGS

3 By making the stiles from square parts thicker than the rails, you can turn them into corner posts or legs. Attach rails and panels on two adjoining faces of shared stiles to form the case corners. To avoid unwieldy glue-ups, assemble side frames/panels before joining them to the front or back panel and rails.

PROS: Corner posts that serve as stiles for two panels reduce weight. The post thickness adds shadow lines.

CONS: Organizing where rails connect to the post faces requires careful layout. Mortise-and-tenon joints take time to make, but they're not your only joinery option, as shown *below.*



Instead of mortise-and-tenon joints, we used a tablesaw dado blade to cut both the stile mortises and rail tenons. A miter-gauge-extension stop limits the tenon length.

Attach backs, bottoms, and tops

You could construct an entire furniture project from framed panels, but that's not always practical for parts such as the bottoms of cabinets and chests. Here's how to incorporate sheet-goods or solid-wood parts.

Rock bottom joinery

We've butted bottom and shelf panels against frame-and-panel sides using only biscuits for alignment, but you'll get even sturdier connections using grooves in the sides, as shown *below left*. Assemblies can be cut on a tablesaw, as shown on *page 59*.

We've got your back

To capture a plywood panel back, check the plywood thickness, and cut rabbets in the insides of the top, bottom, and sides of a frame-and-panel case after it's assembled. Finish the back panel and frame-and-panel case separately; then screw the back in place.

Top off your project

Veneered plywood expands and contracts minimally, so you can glue mitered solid-wood edges to it, as shown *below*, for a frame-and-panel top for your case.

GROOVES HOLD BOTTOM PANEL

Weight on the bottom of this blanket chest will be partially supported by grooves in the sides. A rail beneath the bottom of the chest provides additional support.

FRAMED PANELS MAKE TOPS, TOO

By gluing trim pieces to the edge of a veneered-plywood panel, this top mimics the frame-and-panel look while leaving only a small gap around the panel edges.

10 more tips for frame-and-panel success

1 To make frame parts with consistent color and grain, saw all of them from the same piece of lumber.

2 Mill all parts flat to a consistent thickness; then joint and cut them square. If you start with flat, squared lumber and flat plywood or solid-wood panels, you've got a better chance to make a flat frame-and-panel assembly.

3 When using plywood for flat panels, buy the plywood before you start making the frame. Then measure its thickness, and size the frame grooves accordingly.

4 When making panels from plywood, glue the panel in place on all four sides for a more rigid assembly. Always allow solid-wood panels to float.

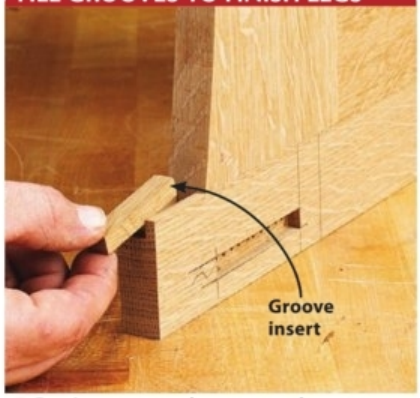
5 Consider making the bottom rails slightly wider than the top rails to avoid making the project appear visually top-heavy.

6 Stain panels before inserting them into frame grooves to avoid exposing bare wood when the panel shrinks.

7 Prevent rattles in floating panels with rubber spacers inside the frame groove. (See **Sources**.)

8 Look for ways to glue up subassemblies before the final project assembly to give yourself plenty of working time. Always do a practice dry run before the final assembly.

FILL GROOVES TO FINISH LEGS



9 **Don't pass on stub-tenon-and-groove frame joints just because the stiles (and grooves) extend beyond the bottom rail. Simply glue a matching insert into the exposed groove, and sand it flush.**

Sources

Project plans: To purchase plans for the projects shown here, visit woodmagazine.com/plans.
Rubber panel spacers: Panel barrels (¼") no. 00508.14, $4.60 for 100, Lee Valley Tools, 800-871-8158; leevalley.com

Written by **Bob Wilson** with **Kevin Boyle**
Illustrations: **John Hartman**; **Roxanne LeMoine**; **Lorna Johnson**

DIVIDE THE FRAME AS NEEDED

10 **Divided frames don't have to be symmetrical as with the sides of this display cabinet where an off-center rail separates the upper display area from the bottom storage.**

Telephone Stand

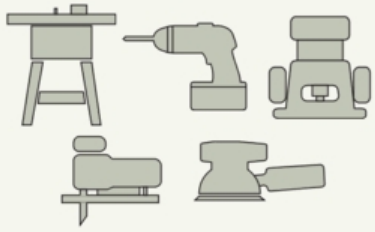
Hold the phone…along with the answering machine, phone book, and plenty more.

BASIC-BUILT™
GREAT PROJECTS MADE SIMPLE.

Dimensions: 15¾" wide × 13½" deep × 28" high.

Clean, elegant lines conceal the straightforward construction of this project. It consists of identical front and back face frames connected by a plywood box that creates two shelves. You'll love the quick and easy joinery consisting of screws in pocket holes for the frame, and glued butt joints holding the box together. And, if you want to tweak the design to suit your tastes, that's easy too. See *page 65* for a different leg design, as well as a door option to conceal items stored on the bottom shelf.

WHAT YOU'LL NEED



Frame it up

1 Start by referring to **Drawings 1** and **3** and deciding which version of the stand you want to build. Make four copies of your chosen leg-bottom pattern from the *WOOD Patterns®* insert on *page 45* and set them aside. Cut the legs (A) to width and length [**Drawings 2, 3**], but don't cut the curves on the bottoms yet.

2 Adhere a leg-bottom pattern to each leg (A) using spray adhesive. For the standard leg pattern, cut along the line with a jigsaw, then sand the curve smooth. For the optional leg pattern, see the **Skill Builder** on *page 65*.

3 Cut the rails (B) to size [**Materials List,** *page 65*; **Drawing 2**]. For the optional stand, lay out and cut an arc in two of the rails [**Drawing 3**]. Then, using a pocket-hole jig, drill pocket holes in each end of the rails [**Photo A**].

4 Start assembling a frame by screwing a rail (B) flush to the top ends of a pair of legs (A) [**Photo B**]. For the optional stand, use the rails with the arc. Then

DRILL THE POCKETS

Clamp a pocket-hole jig to a rail (B), and secure the clamp in a vise. Drill two pocket holes in each end of each rail.

place a 6" scrap spacer below the first rail and against a leg [**Photo C**]. Screw the next rail in place snug to the spacer. Cut a spacer 11¾" long, and use it to position the third rail [**Photo D**]. Repeat this process to assemble the other frame.

Make a case

1 Cut the side panels (C) and shelf panels (D) to size. ***Quick Tip! Eliminate chip-out on plywood.*** Most chip-out happens on the bottom face where the blade exits the panel. Apply a strip of painter's tape to both faces straddling the cutline for a clean cut. Using a sanding block, sand the faces of the panels to 220 grit.

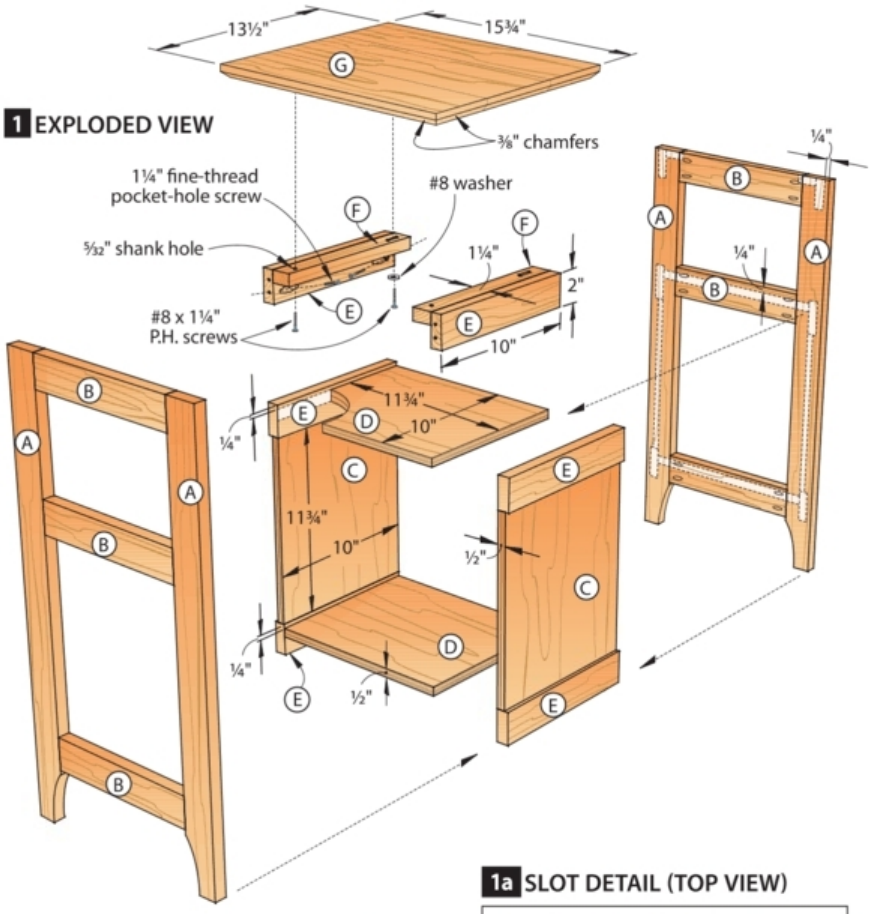
2 Cut six side rails (E) to size [**Drawing 1**]. Glue a side rail to the top and bottom of each side panel (C), keeping their back faces flush and the rail ends flush with the panel edges. Save the two remaining side rails for use later.

3 Make a couple of corner braces as shown in the **Shop Tip** on *page 64*. Glue a shelf panel (D) and side assembly (C/E) together [**Photo E**]. Recess the shelf panel ¼" below the top edge of the top side rail. Repeat this procedure with the other shelf and side assembly, making sure to recess the shelf ¼" from the top edge of the bottom side rail [**Drawing 1**].

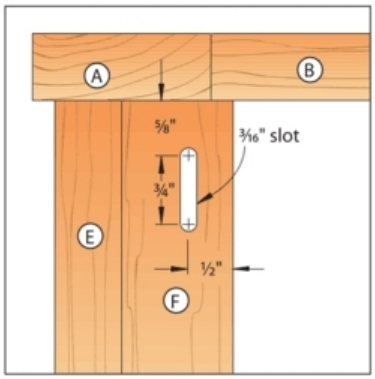
4 After the glue has dried, glue and clamp the two L-shaped assemblies (C/D/E) together [**Photo F**].

5 Finish-sand the box to 220 grit. Then center the box assembly (C/D/E) side-to-side on the lower opening in one of the frames (A/B), with the top shelf (D) ¼" below the top edge of the middle rail (B) [**Drawing 1**]. ***Quick Tip!*** Make light pencil marks inside each corner of the box assembly to help reposition it.

1 EXPLODED VIEW

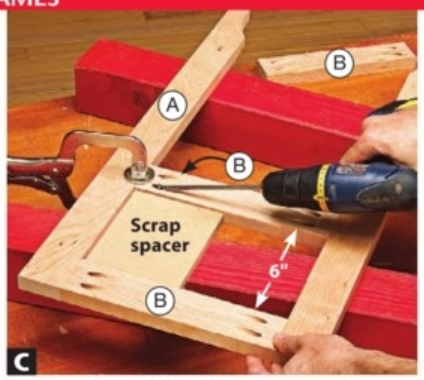


1a SLOT DETAIL (TOP VIEW)

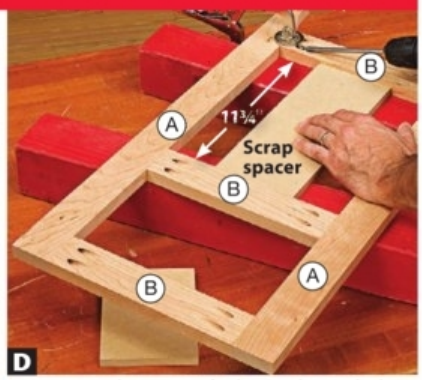


ASSEMBLE THE FRONT AND BACK FRAMES

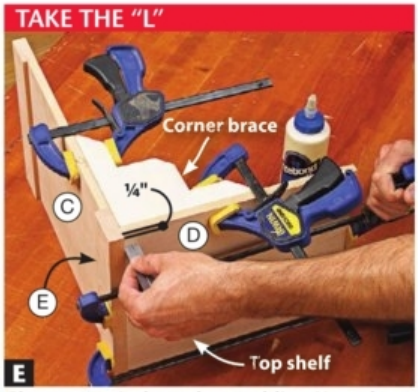
Clamp a rail (B) flush with the top end of a leg (A), and drive two pocket-hole screws. Repeat to fasten the other leg to the rail.



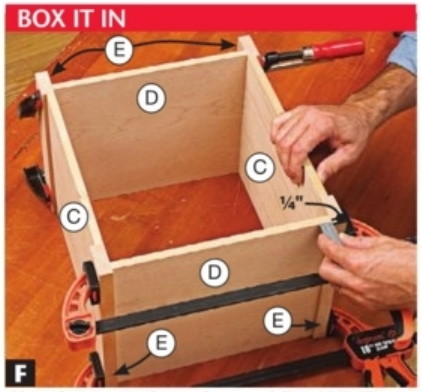
Position the middle rail (B) using a 6"-long scrap. This ensures equal spacing between the first and second rails on both frames.



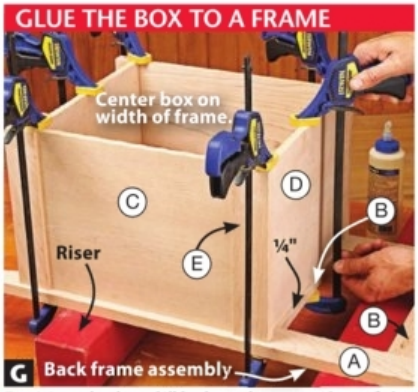
Cut a second spacer 11¾" long. Place it below the middle rail (B) to position the bottom rail, then drive the pocket screws.



Glue up two L-shaped assemblies. Note that the two assemblies will not be identical. Refer to Drawing 1 and Photo F.



Glue the two L-shaped assemblies (C/D/E) together. Check for identical insets on both sides and for square.



Position the box ¼" below the top edge of the middle rail. If you want the optional back (H), add it before attaching the front frame.

Remove the box assembly, apply glue to the edges, and glue it to the back frame [**Photo G**]. ***Note:*** *If you're building the optional stand, cut the back (H) to fit inside the box assembly and glue it to the back frame* [**Drawing 3**]. After the glue dries, attach the front frame following the same procedure.

Take it to the top

1 Retrieve the last two side rails (E). For the optional stand, cut an arc in each rail to match part B [**Drawing 3**]. Use pocket screws to mount the side rails between the legs (A) [**Photo H**].

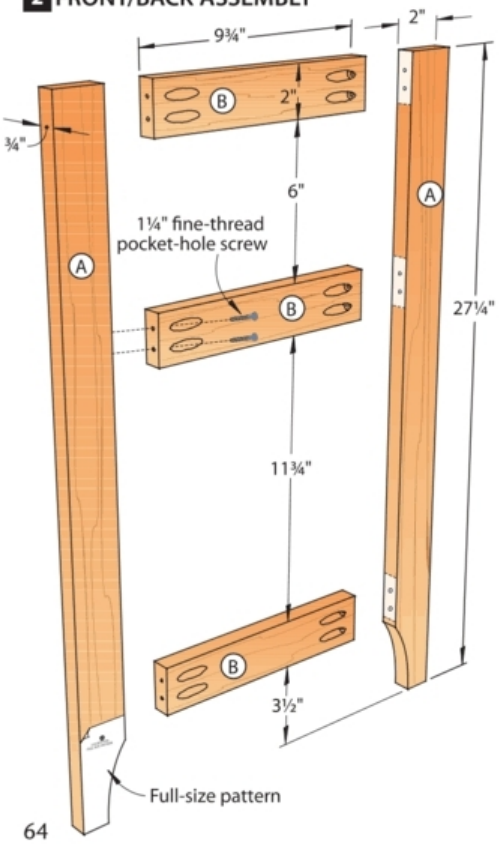
2 Cut the cleats (F) to size. Drill overlapping holes to make a 3⁄16"-wide slot toward one end of each cleat [**Drawing 1a**]. ***Quick Tip! Drilling a slot.*** Lay out the slot location. Drill a hole at each end of the layout, then a hole centered between them. With the drill bit spinning in the middle hole, rock the drill back and forth to remove the waste between the three holes. Drill a 5⁄32" hole at the opposite end of each cleat [**Drawing 1**]. Glue the cleats flush to the top edges of the side rails (E).

3 Edge-glue three pieces of stock to make a blank for the top (G) [**Drawing 1**]. Cut it to size after the glue dries. Rout 3⁄8" chamfers around the bottom ends and edges, then finish-sand the top to 220 grit.

4 Center the top (G) on the base. Secure the top to the cleats (F) using panhead screws at the front and panhead screws and washers through the slots at the rear [**Drawing 1**].

5 Use 220-grit sandpaper to ease the sharp edges of the legs and rails. Clean off the sanding dust, and then apply a finish. (We used Minwax Cherrywood gel stain, then applied three coats of Minwax water-based polyurethane satin sheen finish.)

2 FRONT/BACK ASSEMBLY



May we show you the door?

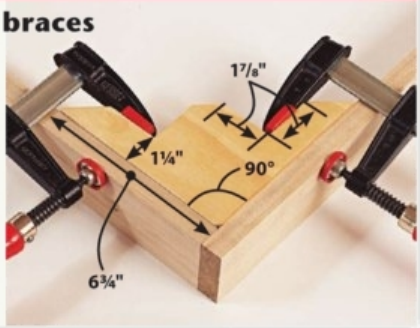
1 Cut the stiles (I), door rails (J), and door panel (K) to size [**Materials List**]. Cut another piece the same thickness as the door rails and stiles to use as a test piece. Set your tablesaw's rip fence 5⁄16" from the blade, raise the blade 3⁄8" above the table, and cut a groove in one edge of the test piece. With the opposite face against the fence, make a second pass to widen the groove. Check the fit of the door panel in the groove. If needed, adjust the fence closer to the blade, and repeat the procedure until the door panel fits snugly. Then cut a groove to accept the door panel in one edge of each door rail and stile [**Drawing 3**].

2 Reposition the rip fence so it is 3⁄8" from the *outside* edge of the blade. Place the test piece facedown on the tablesaw with the groove next to the blade. Set the blade height so the highest tooth is just below the groove. Using your miter gauge to guide the test piece over the blade, make a series of cuts on each face to make a stub tenon [**Drawing 3a**]. If needed, adjust the blade height, and repeat the procedure until the stub tenon fits the groove in a stile (I). When you're satisfied with the fit, cut stub tenons on the ends of each door rail (J) [**Drawing 3**].

SHOP TIP

Get square with corner braces

Once you use these corner braces, you'll wonder how you ever got along without them. Start with a piece of scrap that has a square corner. (We used plywood.) Then cut it to the shape shown in the *photo*. Round off the square corner so project parts rest snugly against the edges. Make larger versions by scaling up the dimensions.



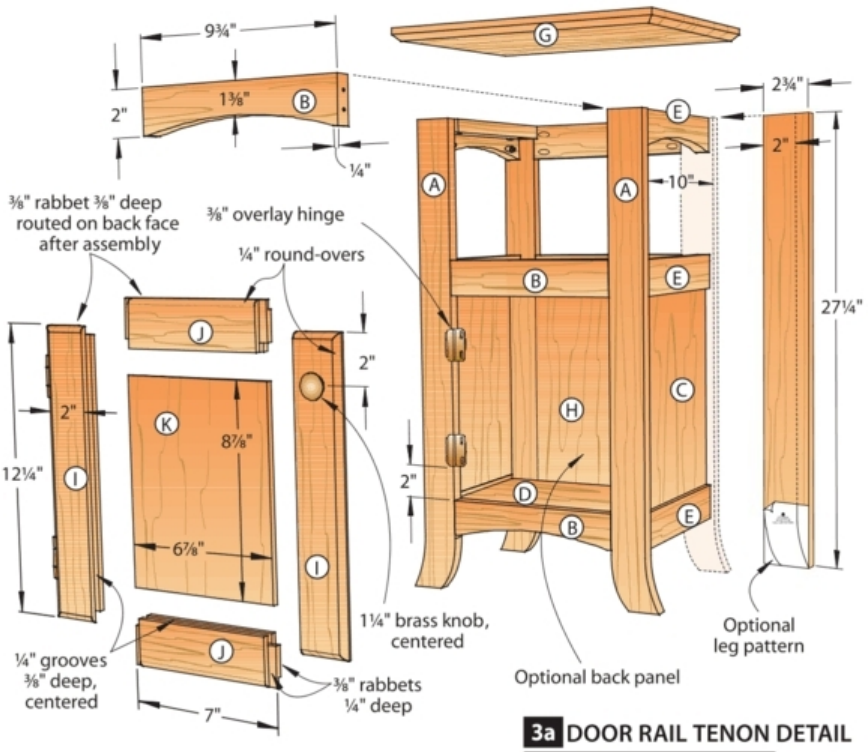
FASTEN THE LAST TWO RAILS

H Clamp the side rails (E) between the frames with their top edges flush and inset ¼". Screw them in place.

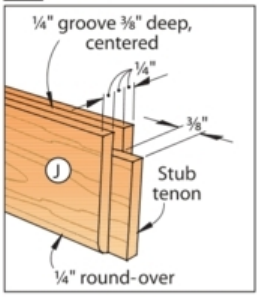
3 Glue the stiles (I), door rails (J), and door panel (K) together. Check the assembly for square. After the glue dries, rout ¼" round-overs around the front edge and a ⅜×⅜" rabbet around the back edge [**Drawing 3**]. Attach the knob.

4 Screw the hinges to the door. To establish an even gap, tape a nickel to the top of the bottom rail (B) and to the edge of the leg (A) that won't receive the hinges. Screw the hinges and door to the cabinet. ***Quick Tip! Fitting a door.*** If the rabbet on the back of the door brushes against a leg or rail, rip the edge of the door slightly, then rout the round-over and rabbet again.

3 DESIGN OPTIONS: DOOR AND CURVED LEG BOTTOM



3a DOOR RAIL TENON DETAIL



Written by **Craig Ruegsegger** with **Kevin Boyle**
Project design: **Jeff Mertz**
Illustrations: **Roxanne LeMoine**; **Lorna Johnson**

SKILL BUILDER

Cut (most of) a curved leg on the tablesaw

Even with the curve on the bottom, you can cut most of the optional leg design on your tablesaw. Start by raising the blade 1" above the saw table, and setting the rip fence ⅝" from the blade. With the outside edge of the leg against the fence, cut along the leg, stopping and turning off the saw when the blade reaches the mark on the pattern (*photo*). Hold the workpiece in place until the blade stops. Complete the curves with a jigsaw, and sand the edges smooth.

Materials List

Part		FINISHED SIZE T	W	L	Matl.	Qty.
A	legs	¾"	2"*	27¼"	C	4
B	rails	¾"	2"	9¾"	C	6
C	side panels	½"	10"	11¾"	CP	2
D	shelf panels	½"	10"	11¾"	CP	2
E	side rails	¾"	2"	10"	C	6
F	cleats	¾"	1¼"	10"	C	2
G**	top	¾"	13½"	15¾"	EC	1

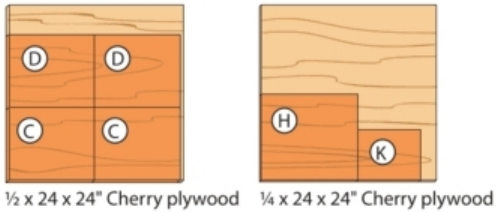
*See Drawing 3 for width of optional leg design.
**Part cut from oversize blank. See the instructions.

Optional Design with Door

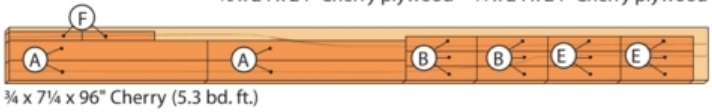
H	back	¼"	11¾"	13¼"	CP	1
I	stiles	¾"	2"	12¼"	C	2
J	door rails	¾"	2"	7"	C	2
K	door panel	¼"	6⅞"	8⅞"	CP	1

Materials key: C–cherry, CP–cherry plywood, EC–edge-glued cherry.
Supplies: Spray adhesive, #8×1¼" panhead screws (4), 1" washers (2), pocket screws. For optional door: 1¼" brass knob, ⅜" overlay hinges.
Bits: 45° chamfer bit. For optional door: ¼" round-over and rabbeting router bits.

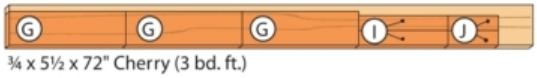
Cutting Diagram



½ x 24 x 24" Cherry plywood ¼ x 24 x 24" Cherry plywood



¾ x 7¼ x 96" Cherry (5.3 bd. ft.)



¾ x 5½ x 72" Cherry (3 bd. ft.)

13 Habits for Shop Success

Experienced woodworkers rely on shop routines to help them consistently achieve top results. Adopt these simple habits to help you get the most out of your shop time.

Success starts before you turn on a tool

1. Plot your course

Before you cut the first board for a project, review the plans, line up all the materials and supplies, and determine what tools and equipment you'll need. Think about the steps involved and how you'll accomplish them. Then jot down a brief list outlining the order for accomplishing the steps, which you can then use as a checklist. You may alter your work plan as the project progresses, but working from a list of everything you need to accomplish ensures that you don't miss something crucial.

2. Make notes, not memories

When a project spreads across several shop sessions, break the work at a logical point whenever you stop. Complete the step you're working on, for instance, instead of stopping in the middle of an operation. Then, write notes on the plans and mark parts so you can easily determine where you left off. You may *think* you'll remember where you stopped and what you need to do next when you return to the project, but human nature says you won't, especially if the break lasts longer than you plan.

Checking off parts on a cutting list as you make them and jotting down notes as you work, help keep your project on track.

3. Banish distractions

Some researchers maintain that the human brain can concentrate on only one task at a time. This means that when we think we're multitasking, we're really forcing the brain to jump back and forth between competing thought processes, giving each only brief snips of attention. The brain's ability to hop from one thought to another, most researchers say, declines with age.

This suggests that you can't focus fully on your woodworking project while debating with talk radio or watching the game on TV. Background music may not be dangerously distracting, but beware if you find yourself singing along.

A project requires your full attention for top results. Distractions and confusion in the shop compromise safety and workmanship.

4. Clear the clutter

Few things waste as much shop time or raise irritation levels as high as misplacing the tool you need (or the one you just laid down) in the clutter on your bench. And stumbling over scraps on the floor as you search just makes matters worse. Everything you need to know about keeping your work area efficient stems from lessons your mom taught.

- Clear scraps, chips, and sawdust off your workbench and tool tables often.
- Toss trash into a can, not on the floor.
- Put away tools you're finished using.
- Set machined parts aside so you won't mistake them for raw stock or scraps. See **Resource 9** on *page 69*.

This uncluttered workbench allows plenty of space for a panel glue-up. A tidy work area is especially important in a smaller shop.

5. Round up your safety gear

Safety equipment only protects you if you use it, and you're more likely to use it if it's easy to find. So keep your personal protective equipment in a designated, visible, and easy-to-accesss place, perhaps near the entrance to your shop. Keep a selection of push sticks, push blocks, and feather boards near each machine where they're needed.

Make safety a part of your setup routine. Before you start a machine, position feather boards, locate pushsticks, put in earplugs, don your safety glasses, and if necessary, find a snug-fitting dust mask or respirator. Then check everything one last time before making the cut.

Accessories such as this pushstick and feather board contribute to accuracy and efficiency, as well as safety.

Mantras for materials and marking

6. Start with blue-chip stock

Joint, plane, and saw stock true and square before you start laying out and cutting parts. Measure to make sure boards that are supposed to be the same thickness really are, and plane at one time all stock that will be a particular thickness. When you mill stock, prepare some extra to test tool setups, joinery, and finishes. Stack prepared stock where it will be safe from damage. See **Resources 2, 3, and 10** on *page 69*.

This board obviously needs work before it's ready to use. Cutting it into shorter lengths minimizes waste. Square all stock.

Start with one straight edge on every workpiece. Then rip the opposite edge parallel and square the ends.

Jointing is essential for stock preparation. A router fills the bill if you don't have a jointer (see **Resource 3** on *page 69*).

7. Make your mark

As you make project parts, put identifying marks on them. If you're working from plans, label the parts with the part letters or numbers from the plan; otherwise use a descriptive name. Mark out oversize blanks to show which parts they'll yield. Label blanks to indicate part position and orientation, too. Simple alignment marks can prevent gluing a piece in backward or in the wrong place. Labels like "top edge" or "back" eliminate confusion and simplify assembly. See **Resource 11** on *next page*.

Label parts for position and orientation as you make them. Chalk-marks, shown here, wipe off easily and don't mar the surface.

When you glue up several panels, mark each with the time you clamp it so you can keep track of the curing time.

8. Measure, measure, cut

The oldest saw in woodworking (yeah, we just had to say that) still holds true: Measure twice, cut once. To maximize accuracy in those measurements, get into habits like these:

- Use the same tape or rule throughout a project for consistency.
- Measure from the same edge or other reference surface on matching parts.
- Make precise marks with a sharp pencil or, better yet, a marking knife.

Sometimes it's better not to measure. To determine the length of this trim piece, hold it in position and mark the cut precisely.

Instead of laying out repeat measurements, lay them out once on a template or story stick for accurate transfer to the parts.

Make sure your tape or rule sits flush with the edge when measuring. This hook rule proves more accurate than a tape's sliding hook.

Best practices for project building

9. Measure, cut, cut, cut ...

Carry out repetitive operations—cutting parts to the same dimension, drilling equally-spaced holes, or routing rabbets, for instance—more consistently, quickly, and easily with stop blocks and jigs. You can buy commercial jigs that simplify many operations, but some of the most valuable ones in your shop will be the ones you create yourself for a specific job. Make it a habit to look for situations where a quickly-made jig—something as simple as a scrap of wood clamped to a miter gauge—will save you from repeated measuring and marking. Make permanent jigs for jobs you do often, such as miter-cutting sides for identical frames. See **Resources 5 and 8** on *next page*.

Set a stopblock accurately by measuring from a kerf cut through the miter-gauge extension to the block.

A simple template saves layout time and ensures accuracy for such jobs as drilling screw holes for hardware.

This shop-made jig sets both the angle and length for sanding matching leg bevels, enabling quick and accurate work.

10. Get the most from a setup

Set up tools, jigs, and equipment for every operation carefully and precisely, lock the adjustments, and test every setup on scrap wood before machining project parts. To avoid repeating setups, rip all same-width parts at once, for instance, instead of resetting the rip fence several times.

When you interrupt a project and leave a setup to use later, write "Don't Change Setup" on a sheet of paper and stick it on the tool. Also jot down the setup specifications and which part you're making with it.

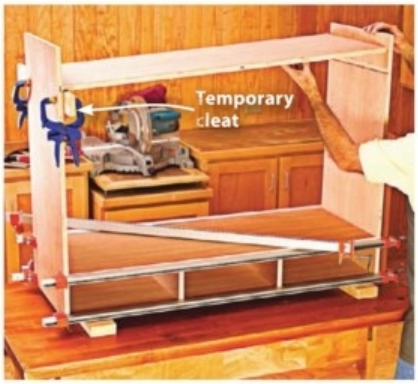
Take a digital photo of a setup you might reuse, print it, and add notes.

Once you've set up a housed dado stack on your tablesaw, you can cut a variety of rabbet widths by simply moving the fence.

11. Dry-assemble everything

Before gluing, assemble the parts without glue to ensure correct fit. Give each part a final inspection as you work, and take note of the order of assembly to avoid glue-up goof-ups. Finally, clamp the dry assembly together.

This assembly rehearsal helps you determine which clamps to use and the best order to apply them. It also can help you identify situations where you might need a helper or temporary support. And after undoing the dry-clamped assembly, the clamps are preset for the real job, further minimizing any glue-up panic and confusion.



Dry-assembly before gluing this project revealed the need for a temporary cleat to support one end of the shelf.

12. Don't settle for dull

The importance of sharp tools almost goes without saying. To make clean, accurate cuts, you need sharp tools.

Carbide-tip saw blades and bits stay sharp longer than steel ones, but except for touching up router bits, you can't sharpen them yourself. When they need sharpening, let a professional do it.

You can sharpen most hand tools, such as chisels and planes, yourself. Hardened teeth on today's handsaws and pullsaws require grinding, another job for a pro sharpener. Some pullsaws and Japanese handsaws feature replaceable blades; it's often cheaper to replace the blade than to have it sharpened. See **Resources 1 and 6** *above*.

You can sharpen chisels and plane irons on a wheel (left) or flat stone (right). Always use a guide to maintain the correct bevel. Sharpening on a wheel results in a hollow-ground blade.

Touch-up router bits between sharpenings by honing the flat back of each cutter blade with a diamond file.

13. Chill, dude

Remember, this is your hobby. You're doing it for fun. These habits will help you enjoy your shop time more:

- Avoid setting project deadlines or creating unrealistic expectations that lead to stress or safety compromises.
- Work at a comfortable pace regardless of the scope of the project. Don't try to hurry through a seemingly simple project, for instance.
- Take the time to learn and understand new or unfamiliar techniques, rather than rushing blindly through the steps just to get done.

Written by **Larry Johnston**

MORE RESOURCES

FREE VIDEO

1. SHARPENING VIDEO
- woodmagazine.com/sharpenvid

FREE ONLINE INFORMATION

2. USING A JOINTER
- woodmagazine.com/jointertips

3. AN ALTERNATIVE TO A JOINTER
- woodmagazine.com/jointersub

4. MEASURING ACCURATELY
- woodmagazine.com/measuretips

5. SIMPLE SHOP JIGS
- woodmagazine.com/simplejigs

RELATED ARTICLES

6. SHARPENING
- "Get Sharp, Stay Sharp," issue 186 (October 2008), available at woodmagazine.com/getsharp $

7. MEASURING
- "Attainable Accuracy," issue 177 (July 2007), available at woodmagazine.com/accuracy $

8. WORKSHOP JIGS
- "Four Task-Tackling Tablesaw Jigs," issue 168 (February/March 2006), available at woodmagazine.com/TSjigs $

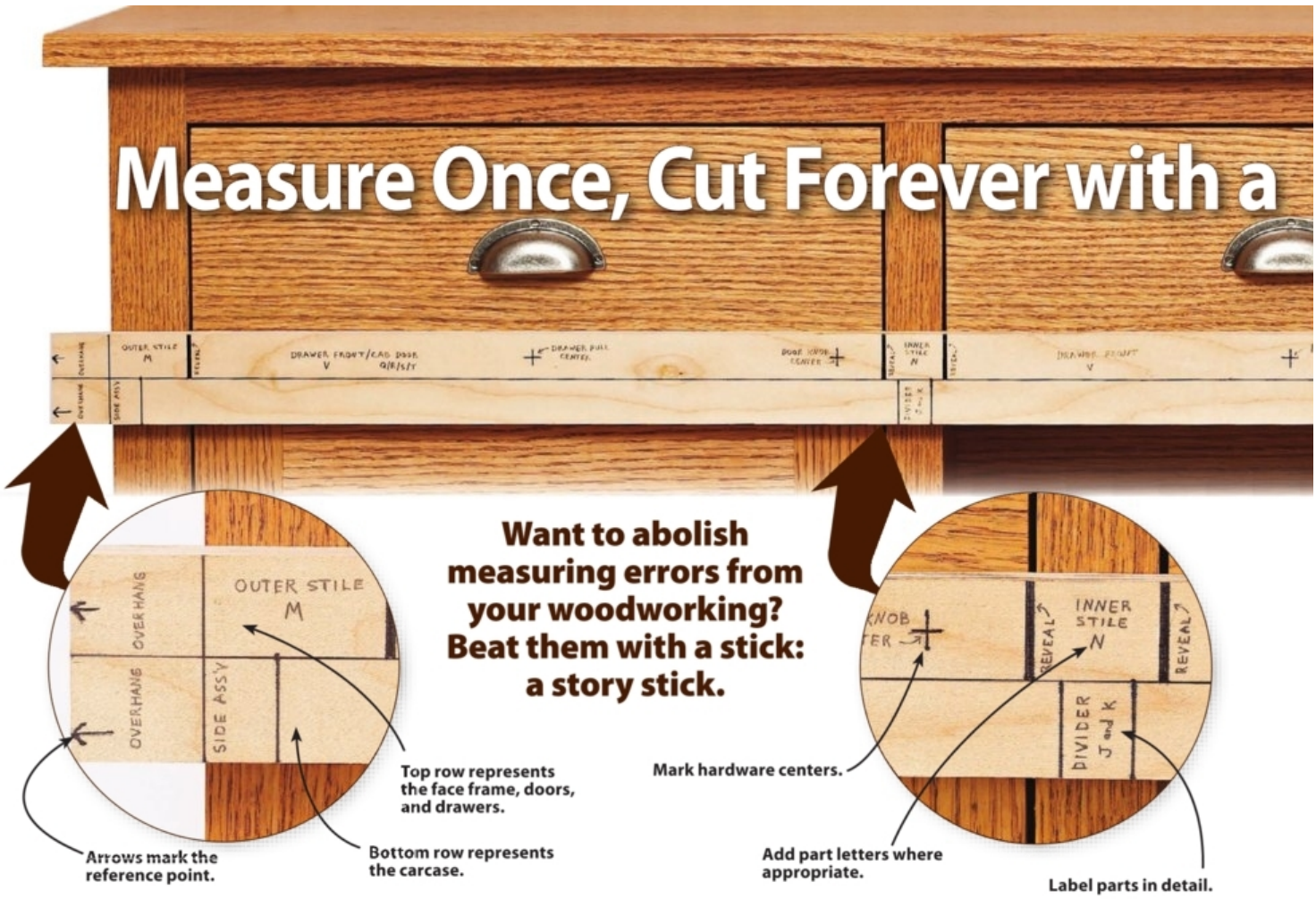
9. SHOP ORGANIZATION
- "17 Ways to Organize Your Shop," issue 166 (November 2005), available at woodmagazine.com/organizing $

10. PREPARING STOCK
- "6 Steps to Perfect Stock," issue 153 (December 2003), available at woodmagazine.com/stockprep $

11. MARKING
- "Make Your Mark," issue 149 (June/July 2003), available at woodmagazine.com/marking $

($=download this article for a small fee)

Measure Once, Cut Forever with a



In woodworking, the tape measure is an unreliable intermediate step, at best. Burn an inch and forget to subtract it during markup, get interrupted after you measure, or mark with a different tape than you measured, and the errors pile up.

However, by directly transferring the layout to a story stick—a tool nearly as old as woodworking—you eliminate much of the opportunity for error.

A story stick, made from nothing more than a strip of wood, contains all of a project's critical measurements marked in full-scale proportion. Taken together, these marks present a precise visual representation—or story—of a project. Here are three great ways to put story sticks to work in your shop.

1 Furniture

Whether you work from published plans or your own, a story stick provides a visual double-check of the design. Make one from a slender scrap of wood 2–3" wide and slightly longer than the longest dimension of your project.

With a pencil and straightedge, divide the stick along its length into two or three rows, as shown *above*, depending on the complexity of your project. Each row represents a different layer of the project—the case, the face frame, doors, drawers, etc.

Transfer measurements directly to the part blank, aligning it to display the most pleasing grain pattern or for efficient material use.

Starting from one end of the story stick measure and mark the critical dimensions of the project, clearly labeling each measurement. Mark the width layout lines on one side of the story stick (as shown here) and height on the other. If necessary, reserve a third row for the depth dimensions.

To use the story stick, butt the project part blank against the story stick and transfer the dimensions with a combination square to mark the locations of rips and crosscuts, as shown, *left*. Then, set your tablesaw fence or mitersaw stops to cut on the line rather than relying on tape measures.

2 Reproductions

Along with detailed photos, a story stick makes a perfect tool to accurately reproduce a piece of antique furniture—especially when excess handling is a concern. Simply hold the stick alongside the piece and transfer all dimensions directly onto the stick. Back in the shop, you won't have to fudge the design details to fit estimated measurements; you'll have them completely contained in one convenient place.

Story Stick

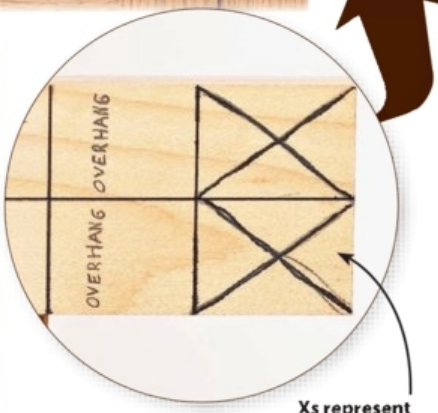
3 Built-ins

Story sticks excel in the production of built-ins, such as a niche bookcase, a window seat, or even a complete set of kitchen cabinets. For a built-in application, you'll need two story sticks with a combined length several inches longer than the built-in space or room wall.

Place double-faced tape on one stick where the two will overlap. Then stack the sticks and place them on a level line on the wall. Slide them outward to fit the space and tape them together. Mark index lines across both sticks so that they can be precisely lined up later, as shown, *right*, and tack the stick's end to the wall with small nails.

Mark any necessary cutouts, such as outlet and pipe locations, to eliminate measurement miscues back in the shop. Finally, add cabinet measurements in relation to the space's dimensions and architectural details, ensuring a pleasing layout and a proper fit (such as centering a sink beneath a window).

Transfer distant measurements to the story stick with a level. Then transfer the marks to the face of the story stick with a square.



Xs represent unused length.

Happily ever after

After completing your project, store your story stick, plans, setup gauge (see Shop Tip, *below*), and any specialized jigs together in one location. When you're ready to duplicate that masterpiece, the story stick will be there to help you do it quickly and precisely.

Written by: **Lucas Peters**

SHOP TIP

A setup gauge: The rest of the story

The setup gauge, a close cousin to the story stick, makes it easy to quickly return your tablesaw fence to the proper position for rip cuts. Setup gauges can be as simple as offcuts that have been saved from an oversized project blank. Or make a single long setup stick for each project.

After each final cut, lower the blade to just above the tabletop and cut a slot in the setup stick. Label the slot with the part name. The next time you need to make a part of identical width, place the blade in the slot and butt the fence against the end of the stick.

WOOD JOINT TORTURE TEST #3

Outdoor Adhesives

Learn which outdoor adhesives have what it takes to stick around after a brutal winter, a soggy spring, and a hot, humid summer.

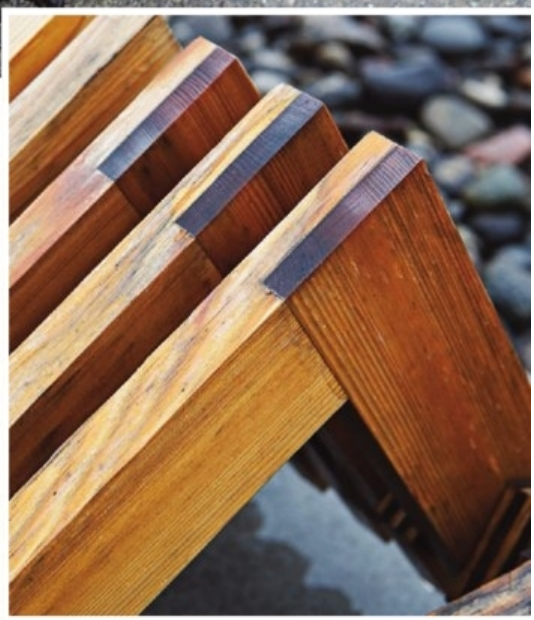
Think "outdoor adhesive" and the word "waterproof" may come to mind. But joints made with these adhesives need to survive more than mere rain. Climate extremes in parts of the U.S. go from subzero to 100+ degrees—challenging for any adhesive.

To discover which adhesives stand up to Mother Nature, we tested four types of products—a type-3 waterproof glue, a type-2 water-resistant glue, epoxy, and polyurethane—on dozens of half-lap and mortise-and-tenon joints in cedar. Why these joints? The half-lap exposes glue lines to the elements, as shown at *right*, while mortise-and-tenons prove vulnerable to checking on the end grain closest to the mortise. And outdoor projects frequently call for one or the other of these joints.

Half the test group bore the brunt of nine months anchored to the roof of our Midwest offices, enduring snow and freezing rain, shirt-soaking humidity, and 39" of rainfall—9" above normal. To provide a baseline for comparison, we created another set of identical joints that suffered only a little sawdust inside our workshop.

Then came crunch time. At the Iowa State University Structural Materials Testing Facility, we fed both groups to a machine capable of applying and measuring thousands of pounds of force. We applied downward force against the short leg of each joint until the glue or the wood failed. (Watch a video of the tests at woodmagazine.com/jointtest3.) If the break exposed more than half the joint, as measured with a 100-grid scale, we considered that a glue failure. Less than half signaled a wood failure.

So which adhesives worked best? We thought you'd never ask.



Glue lines on these half-laps wrap around the corner of the samples, while end grain absorbs and wicks away moisture.

Type-3 wood glue: Equals epoxy without the mess

How type-3 glue works: Water in yellow glues carries microscopic polymer strands into the cells of the wood parts being joined. As the water evaporates, the strands harden to give the glue strength to hold parts together. In type-3 glues, a chemical reaction between the strands also locks them together to withstand severe moisture.

Test results: Outdoor half-laps and mortise-and-tenon joints tested nearly the same as both groups of indoor samples [**Photo A**] as measured in both wood transfer and break strength.

- Paper-thin layers of wood transferred between the outdoor half-lap parts, but that doesn't signal lack of strength. The force required to break the outdoor type-3 half-laps was greater than that to break the outdoor epoxy joints, suggesting they'll perform about the same in real-world projects. Cracks on the ends of the half-laps left the joint unaffected.
- On the outdoor mortise-and-tenon samples, two tenons broke completely off before the glue joint failed [**Photo B**]. That was despite moisture reaching the mortises through end checking.
- **Conclusion:** Despite peeling off thin layers of wood in places where the half-laps touched [**Photo C**], it also tore off large chunks where the glue bond outlasted the strength of the weathered wood. Type-3 adhesive rivals the epoxy's strength in both types of outdoor joints without the mixing mess.

CHECKING DIDN'T AFFECT BONDS

TYPE-3 OUTLASTED THE WOOD

COUNTING UP THE DAMAGE

A 100-square grid on acetate helped us calculate the amount of major and minor wood transfer, a sign this type-3 adhesive has done its job.

Type-2 wood glue: Resists water *and* deterioration

How type-2 glue works: Polymer strands penetrate the wood cells and intertwine like type-3 glues, but these strands don't interact with each other to become thoroughly waterproof. The glue finishes bonding when the water in it evaporates as the polyvinyl acetate formula penetrates the wood cells.

Test results: As with the type-3 glue, outdoor half-laps made using type-2 glue nearly equaled the strength of the joints left indoors for nine months. On outdoor mortise-and-tenon joints, wood transfer dropped only slightly from that of the indoor joints.

- Wood transferred in thin layers on both indoor and outdoor half-laps, but that signaled no lack of strength. Type-2 joints required as much or more force to break than joints using epoxy, which pulled off larger chunks. On some type-2 half-laps, most of the half-lap on one part remained bonded to the mating piece [**Photo D**]. And type-2 glue works without mixing or messy cleanup.
- Outdoor mortise-and-tenon joints using type-2 glue retained more of their original strength than any other type of adhesive tested. Despite checking on the mortise piece ends, glue around the tenons still pulled off considerable material from the mortise sidewalls [**Photo E**]. The glue bonds around the mortise shoulders also held up, despite glue-line exposure to the weather.
- **Conclusion:** Although type-2 glue isn't marketed as waterproof, outdoor half-lap joints made with it proved as strong as joints bonded with type-3. If the phrase "water-resistant" still leaves you uncertain about how it will weather, switch to a type-3 adhesive—which often has a longer working time—or thoroughly seal the project with multiple layers of primer and paint.

OUTDOOR JOINTS STAY STRONG

GLUE BONDS TORE AWAY WOOD

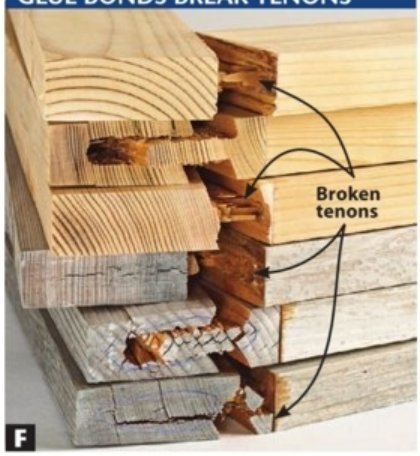
Epoxy: A strong adhesive that weathers well

How epoxy works: Epoxy resin and a curing agent, or "hardener," react chemically when mixed. That reaction forms a bond between the epoxy and the surface so strong that it displaces air or moisture, the reason some epoxy can cure underwater. The shape of the epoxy molecules also helps them form strong bonds with each other. For this test, we used an extended-time epoxy suitable for assembling large projects.

Test results: Epoxy joints left indoors tested the strongest of all four adhesives. On two of the three indoor mortise-and-tenons, the tenons snapped before the glue bond broke. But after nine months outside, joint strength tested about equal to type-2 and -3 glues. Of the three outdoor mortise-and-tenon samples, two tenons broke [**Photo F**].

- End-grain checks on the outdoor mortise-and-tenons allowed water to reach the tenons, but apparently didn't affect the adhesive bond [**Photo G**].
- The edges of one half-lap piece remained bonded to the end grain of the mating piece on both the indoor and outdoor samples [**Photo H**], suggesting epoxy makes a good choice for outdoor half-lap joints partly because it creates water-repelling joint lines.

GLUE BONDS BREAK TENONS



F

- **Conclusion:** Epoxy proved stronger than the wood in all but one outdoor half-lap. Use it for outdoor projects with less-than-perfect joints or for joining unlike materials.

TENON TEARS OFF MORTISE WALL

G

PART OF BOTH HALVES TEAR OFF

H

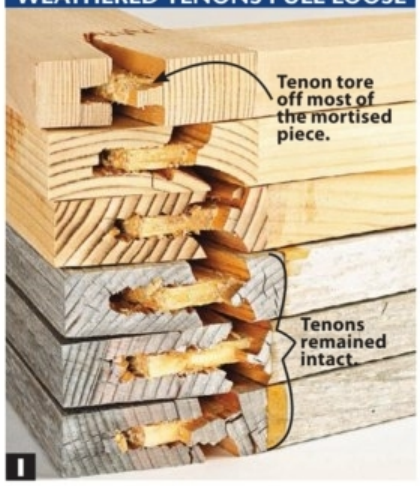
Polyurethane: Its hold fades like the wood

How polyurethane works: Polyurethane adhesive cures in reaction with moisture, but water doesn't carry it into the wood cells as with type-2 and type-3 glues. Polyurethane sticks to a wide variety of surfaces, including wood and metal. Carbon dioxide released in the curing process causes foaming.

Test results: Indoor half-lap samples tested far stronger than indoor mortise-and-tenon samples, but both dropped in strength after exposure. All three outdoor mortise-and-tenon joints suffered glue failures.

- Although the tenon on one indoor mortise-and-tenon sample tore away chunks of the mortised piece, all three tenons from the weathered samples experienced glue failure [**Photo I**].
- On indoor half-lap samples, polyurethane outlasted the wood where the faces met [**Photo J**]. On the outdoor half-lap samples, half-lap shoulders also tore out mating wood on the opposite pieces, confirming test results suggesting they're stronger than mortise-and-tenon joints.
- Among the outdoor joints, mortise-and-tenon joints broke easier than the half-laps, which are simpler to make.
- **Conclusion:** Polyurethane does an excellent job of joining unlike materials, such as a metal cap on a wooden post, but you can find weather-hardy, less messy wood-to-wood joint choices.

WEATHERED TENONS PULL LOOSE



I

WOOD FAILED BEFORE THE GLUE

J

Overall conclusions: Use yellow glue on most wood-to-wood joints

If you doubted type-2 and type-3 yellow glues would last if used to build an outdoor chair or garden arbor, worry no more. They might be a little shy of epoxy in initial strength, but exposure to the elements leaves type-3 glue with about the same holding power as epoxy, especially in mortise-and-tenon joints. Type-2 glue didn't equal epoxy mortise-and-tenon joints, but it held wood equally well in half-laps. What's more, these yellow glues offer easy application and cleanup, no mixing mess, low cost, and familiarity for most woodworkers.

For occasions when your joints are less than perfect, epoxy has the advantage of filling small gaps better than yellow glue, which likes a tight-fitted joint. It also bonds metals and plastic to wood.

And while polyurethane didn't retain as much of its original strength as the others and suffers foam-out problems, it's a lower-cost alternative to epoxy for joining wood to metal.

Start-'em-early Kids' Tool Tote

Looking for a quick and easy project sure to delight a child? In just an evening or two, and using only a tablesaw, scrollsaw, and small pieces of ¾" medium-density fiberboard (MDF) and ¼" hardboard, you can make this toy set.

The handled tote makes it easy for a young woodworker to move his or her tools about.

Cut and assemble the tote and tools

1 From ¾" MDF, cut the base (A) and handle (B) to the sizes listed in the **Materials List.**

2 Make one copy of the full-size handle pattern and two copies each of the two tool tote patterns from the *WOOD Patterns®* insert. Spray-adhere the handle pattern to the handle. Set the other patterns aside.

3 To form the opening in the handle, drill two ¾" holes, where shown on the pattern, using a Forstner or spade bit and a backer to prevent tear-out. Then, using a no. 12 blade with 6 to 12 teeth per inch in your scrollsaw and cutting along the pattern lines, complete the opening. Now cut the handle exterior to shape. Remove the pattern using a cloth moistened with paint thinner.

4 Rout ⅛" round-overs on the base (A) and handle (B), where shown [**Exploded View**]. Using a sanding block, sand the parts to 180 grit.

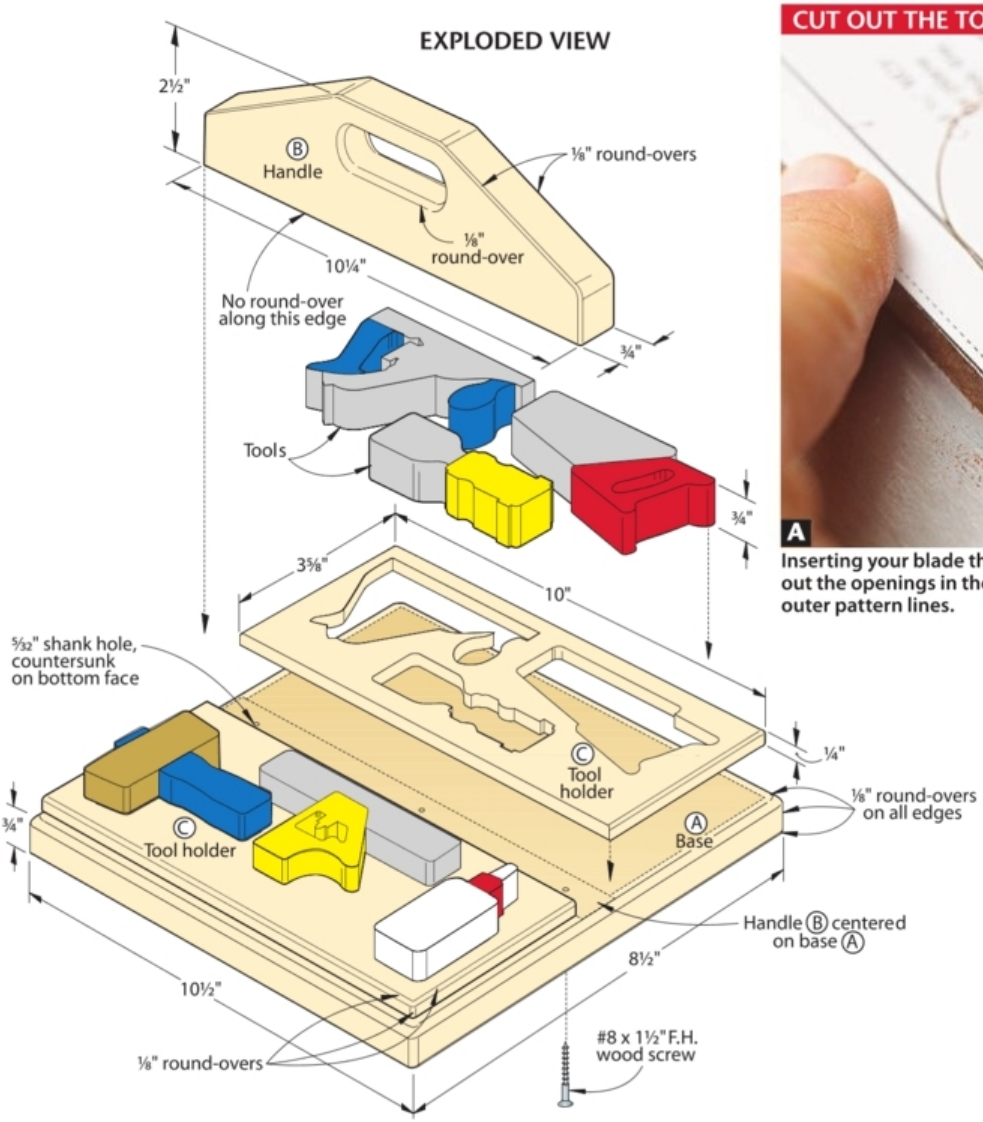
5 Glue and clamp the handle centered on the base, using a combination square to check for equal measurements to the handle from opposing edges of the base. Drill the mounting holes through the base and into the handle, and drive the screws.

6 From ¼" hardboard, cut the two tool holders (C) to 3⅝×10". Then, to make the tools, cut two tool blanks (D) to the same size from ¾" MDF. Using the tool tote patterns copied earlier, spray-adhere one copy to the hardboard blanks and the other copy to the MDF blanks.

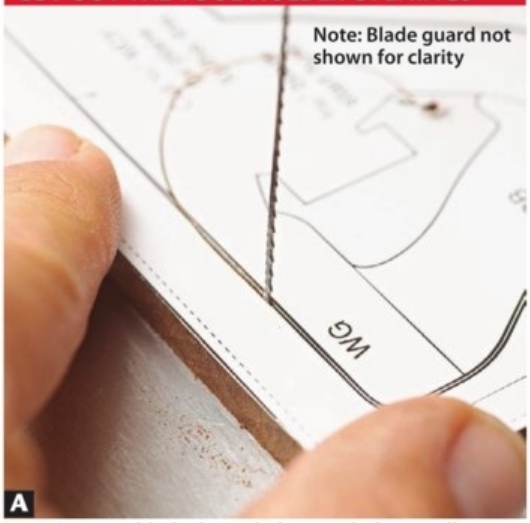
7 To form the openings in the tool holders (C), drill a 3/32" blade start hole through each tool on the patterns anywhere within the cutlines. Then scrollsaw out the tool-shape openings, as shown in **Photo A**, cutting along the *outer* pattern lines. This will create approximately 1/16" clearance for the tools, which are defined by the *inner* lines, to ensure easy insertion and removal in the holders.

8 To cut out the tools from the ¾" MDF blanks (D), drill 3/32" blade start holes through the shaded waste areas on the saw, plane, and combination square, where shown on the patterns. Scrollsaw out the areas. Then cut the tools to shape along the *inner* pattern lines.

9 Rout ⅛" round-overs on the tool holders (C), where shown on the patterns and **Exploded View**. Then remove the patterns from the tool holders and tools. Sand the parts smooth, lightly rounding over the edges of the tools.



CUT OUT THE TOOL-HOLDER OPENINGS



Inserting your blade through the start holes, scrollsaw out the openings in the tool holders (C), cutting along the outer pattern lines.

10 Glue and clamp the tool holders (C) to the top of the base (A), where shown, tight against the handle (B) and centered side-to-side.

Apply the colorful paints to the project

1 Sand any areas that need it to 180 grit, and remove the dust. Then apply two coats of primer to the tote and tools, ensuring you saturate the thirsty edges of the MDF and hardboard. (We used Rust-Oleum Painter's Touch aerosol, no. 1981 White Primer.) Sand lightly to 220 grit between coats to remove the raised fibers.

2 Apply two coats of paint to the tote and tools using colors of your choice or following the color key on the *WOOD Patterns*® insert. We used Painter's Touch aerosol, no. 1994 Almond, for the tote assembly (A/B/C). For the two-tone tools, we used the Painter's Touch colors identified on the patterns, painting the complete tools with two coats of one color, and then masking them where necessary to paint the areas with the second color, where shown on the patterns. For example, we painted the entire chisel with two coats of no. 1982 Winter Gray, masked the blade, and then painted the handle with two coats of no. 1945 Sun Yellow.

3 Finally, after the paint dries, present the tool tote to a child, and watch the excitement begin as he or she plays with the tools and matches them to the openings in the holders.

Written by **Owen Duvall** with **Jeff Mertz**
Project design and illustrations: **Mike Mittermeier; Lorna Johnson**

Materials List

Part		FINISHED SIZE T	W	L	Matl.	Qty.
A	base	¾"	8½"	10½"	MDF	1
B	handle	¾"	2½"	10¼"	MDF	1
C	tool holders	¼"	3⅝"	10"	H	2
D	tool blanks*	¾"	3⅝"	10"	MDF	2

*The tool blanks are used to make the tools.
Materials key: MDF–medium-density fiberboard, H–hardboard.
Supplies: Spray adhesive, #8×1½" flathead wood screws (3).
Blade and bits: ⅛" round-over router bit, ¾" Forstner or spade bit, no. 12 scrollsaw blade with 6 to 12 teeth per inch.

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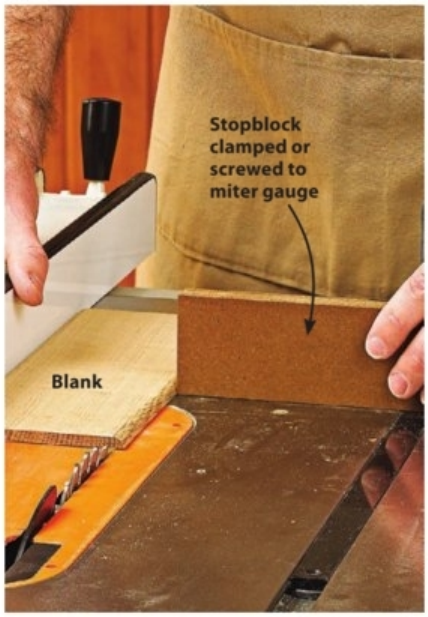
Turn out tiny trim on the tablesaw

Q • I need some ¼" quarter-round • trim for a paneled door but I can't find any at the store. Is there a way to make it?

—Ben Robie, Ankeny, Iowa

A • Start with stock planed to the • thickness of the desired radius—¼" in your case, Ben. Using a table-mounted router, rout a ¼" roundover on both edges of the blank.

Position your tablesaw fence to rip ¼" from the offcut side of the blade. Place a stopblock against the blank as shown, and clamp or screw the block to your miter gauge. Remove the miter gauge before ripping the quarter-round from one edge. Then replace the miter gauge, turn the blank end-for-end, and place the cut edge against the fence. Slide the fence and blank until the blank again touches the stop block. Lock the fence, remove the miter gauge, and rip the next piece of quarter-round. Repeat the routing and ripping process as needed.



A stopblock on your miter gauge makes it easy to position the fence for repeatable and accurately sized quarter-round trim.

After setting the fence, remove the miter gauge and stop block for each cut. Rout, reset, rip, and repeat as needed.

Deadblow mallet: the cure for tight joints

Q • My dovetail jig manual • suggests using a dead-blow mallet on tight joints. What is it, and why should I buy one?

—Lonnie Marks, Springfield, Ore.

A • Lonnie, a deadblow mallet is a • specialized hammer that delivers a solid, controlled blow. Steel shot within its hollow head moves forward immediately behind the hammer blow to eliminate any rebound and transmit additional force. This makes it perfect for delivering controlled strikes. The large head spreads the force across a wide area making it the tool of choice for joints with delicate parts. And because you can deliver more force in a shorter swing, they're great in tight spaces. Many deadblow mallets feature plastic faces or a urethane coating to prevent marring wood.

If you'd rather build than buy one, you can find plans for a wooden deadblow mallet in the October 2005 issue of *WOOD®* magazine.

Our deadblow mallet features leather-covered faces to prevent marring.

Small part routing: "Fingers off" keeps fingers on

Q • I have a 3×4" project part that • requires a routed round-over. I was about to do it on the router table, but became nervous when I saw how close my fingers would be to the bit. How can I rout this safely?

—Anthony Stiles, Keystone Heights, Fla.

A • You're smart to keep your fingers • well clear of the bit, Anthony. Safely extend your reach by securing the workpiece in a wooden handscrew clamp. To secure the piece, set it and the clamp on the router table before tightening the handscrews.

Clear the air on labels

Q: I hired a licensed electrician to run power to my shed workshop. When the building inspector checked that work, he told me I couldn't use my air cleaner plugged into a ceiling outlet because it lacked Underwriters Laboratories (UL) approval. I returned that air cleaner to the store and searched for a replacement, but found that few air cleaners are UL-approved. Am I the only one to run into this?

—Ed Thompson, Matthews, N.C.

A: That's the first time we've heard of a building inspector disallowing a manufactured air cleaner, Ed. But you're right that most air cleaners lack certification from Underwriters Laboratories or any other testing service recognized by a majority of the state or local building codes modeled after the *International Residential Code*.

Different states have different requirements concerning the sale and use of noncertified electrical devices in home workshops, so the only sure way to know what's allowed where you live is to contact your local building department. In North Carolina, all electrical devices must be evaluated for safety by a qualified testing service recognized by the state. In addition to UL, those include the Canadian Standards Association (CSA) and Intertek Testing Services, which uses the ETL logo. Check for either logo, shown *at bottom*, as well as the UL mark when shopping for equipment.

Bottom line: Your building inspector enforces that state law and has absolute authority to say what electrical devices can be installed. So while an uncertified air cleaner may still be safe, it may not be legal in your state.

If you're wondering why all equipment—not just air cleaners—doesn't carry some testing service logo, it's because product testing and certification can be expensive. One manufacturer estimates that initial testing and certification costs exceed $10,000 per product, not including annual certification maintenance costs. In a quick check of the stationary and benchtop machines in the *WOOD*® magazine workshop, two-thirds lacked any certification, and none carried a UL label.

continued on page 80

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Ask WOOD

A cure for the brown-wood blues

Q: The model car plans I'm using suggest padauk for its red-orange color. But the salesperson at the hardwood store said that it will darken to almost black. Is this true? I'd rather have the red-orange.

—Ralph Wolfe, Olympia, Wash.

A: Unfortunately, Ralph, nearly all brightly colored woods, including padauk, will change colors fairly quickly after machining. Padauk turns a deep-brown color with only hints of its red-orange core. Even finish barely slows the color change. Ask your hardwood dealer for Chakte Viga (*Caesalpinia platyloba*). Though it, too, will darken over time, this Latin American wood retains its red-orange color longer than padauk. If you'd prefer to move to the red side of the spectrum, consider bloodwood (*Brosimum paraense*). Bloodwood retains some of its deep-red character as it darkens to a rich brown.

For locking in a desired color, however, look into dyes. Our recipe for brilliantly colored toy finishes from the September 2006 issue (issue 164, page 26, or available for purchase at woodmagazine.com/colorfuldyes) consists of water-soluble TransFast (homesteadfinishing.com, 216-631-5309) or W. D. Lockwood dyes (wdlockwood.com, 866-293-8913) added to a water-based gloss finish. Apply the tinted water-based finish as you would any clear finish. The great thing about dyes: They work well on less-expensive, light-colored domestic woods, like maple or birch, and you can mix your own custom-colored finish.

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Sticky sap situation

Q: I recently built picnic tables out of rough-sawn pine that had been air-dried outside for about 8 years. But sap constantly bleeds out around the knots, making it impossible to sit in certain spots. Do you have any suggestions?

—Darrell Verheyen, Ashwaubenon, Wis.

A: Unfortunately, Darrell, pitch bleeding often occurs in pine that has been air-dried—even years after cutting. The process of "setting the pitch" in sap-soaked wood relies on heat rather than time. Heat the wood enough, and the pitch will "volatilize," either evaporating or crystallizing. That's why kiln operators often heat pine to around 160° F.

In your situation, given time and enough seasonal temperature highs, the pitch bleeding will eventually run its course. In the meantime, remove the sap with a scraper and sand away any hard residue. Then, apply a coat of a de-waxed shellac sealer, such as Zinsser SealCoat Sanding Sealer (zinsser.com, 732-469-8100), trapping the sap under the surface. If some pitch still bleeds through, remove the sap again, and apply another coat of sealer to the trouble spot.

For severe pitch bleeding, use a scraper or chisel to remove any crystallized sap.

Fingering the right glove

Q: To protect my skin, I put on latex gloves when working with solvents. But when I take them off, I often find that the solvent has penetrated the glove. Am I using the wrong glove?

—Donald Wilmont, Bloomington, Ill.

A: Latex gloves provide good protection against water-based solutions, Donald. But organic solvents, such as acetone, lacquer thinner, denatured alcohol, and mineral spirits, can permeate latex. Instead, look for nitrile gloves, shown at *right*, that won't break down when exposed to most common shop chemicals. Nitrile gloves are also a good choice for anyone with latex allergies.

These better gloves cost about 50 percent more than the latex ones, but don't try to stretch your dollar by hanging on to old gloves because solvents eventually permeate even the best gloves.

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About our product tests

We test hundreds of tools and accessories, but only those that earn at least three stars for performance make the final cut and appear in this section. Prices are current at the time of article production and do not include shipping, where applicable.

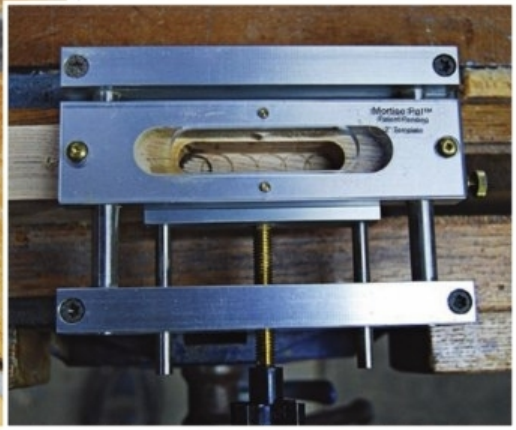
Rout mortises as quickly as dowel joints

Like any good furnituremaker, I prefer to use mortise-and-tenon joints when possible to achieve maximum strength. But setting up and machining these joints can be time-consuming, so I'm always looking for ways to speed up the process. As an alternative to setting up a hollow chisel mortiser, I've used many shop-made jigs with a plunge router. But that's one more thing I have to make, and typically they're not easily adjustable.

That's why I like the Mortise Pal mortising jig. It clamps onto a workpiece as easily as a doweling jig, adjusts in all four directions (it even microadjusts), and has easy-to-see-and-use indexing marks. With this jig, I simply referenced from the same workpiece face—regardless of thickness—and never lost the reliable alignment. Four removable templates make mortises in ½, 1, 1½, and 2" lengths, using the same guide bushing and any spiral or straight bit you choose.

There's also an optional doweling template ($10) for this jig that utilizes the same registration markings, so you can rout dead-on dowel holes just as quickly and precisely.

—Tested by Matt Seiler



Chicago resident Matt Seiler builds custom furniture for a living, and hosts *WOOD Online®* forums.

Router Mortising Jig

Performance	★★★★★
Price	$200

Mortise Pal
619-459-7951, mortisepal.com

Super-efficient cyclone in a compact package

Oneida's Portable Cyclonic Dust Collector might just be the perfect dust collector for a small shop that doesn't have a central system. This unit packs two heavy-duty cyclone separators with filters and collection bins into about the same footprint as a typical 1- or 1½-hp dust collector. Plus, it rolls around nimbly on four swiveling casters. And it gets rid of dust like nobody's business.

It delivers enough airflow (measured in cubic feet per minute) to gobble up all the dust and chips from every machine I hooked it to. Even with fine sanding dust, this unit's cyclonic separation—heavier chips and dust particles fall into the collection drum and never reach the impeller—worked so well that little dust got to the filters, and what did I knocked loose easily with the crank-style cleaners.

After testing nearly 20 dust collectors in the past year, I'm convinced this one will maintain its high collection and filtration capabilities longer than bag-style collectors. Sure, the Oneida sells for nearly $1,400, but it's worth the price, especially if you regularly work with MDF and its fine, messy dust. I tested the 2½-hp dual unit, but Oneida now also offers a 110-volt model, the Mini-Gorilla, with one separator and filter, that sells for $890.

—Tested by Jeff Hall

Jeff Hall, a high school woodworking teacher for 22 years, has tested tools for *WOOD®* magazine for 8 years.

Portable Cyclone Dust Collector

Performance		★★★★★
Price	2½ hp (#XXP020100)	$1,395
	3 hp (#XXP030100)	$1,650

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continued on page 84

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Shop-Proven Products

Rotating outlet solves right-angle-plug issues

As soon as I saw the 360Electrical Rotating Duplex Outlet, I envisioned the perfect place for one in my shop. Because of limited outlets at my disposal, I'm forced to plug in two cords that have right-angle plugs at the same outlet. But both cannot be plugged in at the same time because the top one's cord covers the bottom receptacle. So I have to unplug one to use the other.

With the Rotating Duplex Outlet, I plug in both by simply swiveling them in opposite directions, as shown *below*. Copper contacts encircle each receptacle, so no matter how far you rotate them, they maintain current flow. The duplexes fit in standard electrical boxes. They come in 15-amp capacity, but 360Electrical says they're also developing 20-amp, GFCI, and four-outlet units.

—Tested by Larry Johnston, Projects Editor

Rotating Duplex Outlet

Performance	★★★★★
Price	$12

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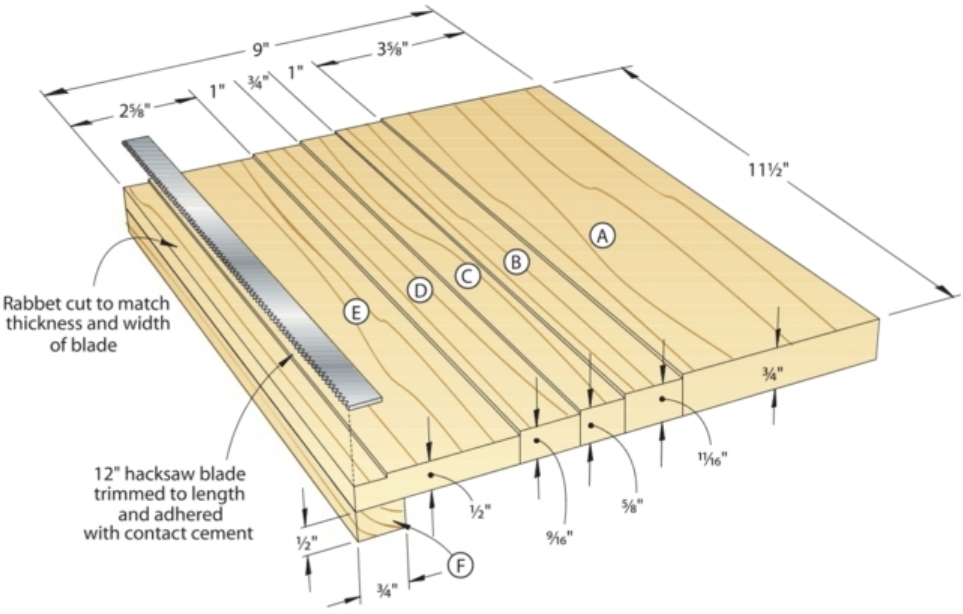
Sandpaper Cutter

Tear sandpaper to the right size every time with this simple stepped cutter.

Cutting sandpaper to size for ⅙-, ⅓-, ¼-, or ½-sheet power sanders and sanding blocks becomes a lot easier when you use this jig to both measure the paper, and cut it straight in one quick move.

The drawing, *right*, shows dimensions for a jig that cuts sandpaper to 2⅝", 3⅝", 4⅜", or 5⅜". You can alter step widths to accommodate custom sanding blocks you might use in your shop.



Building the jig

Start with a piece of ¾" hardwood (we used oak) about 10½" wide × 12" long (or long enough to pass through your thickness planer safely). Rip a 3⅝" piece from one edge, label it as Part A, and set it aside.

Plane the remaining piece to 11⁄16" thick, using your thickness planer. Then rip a 1" strip from the planed material, mark it as Part B, and set it aside. Plane the remaining piece to ⅝" thick, and rip a ¾" strip from it (Part C). Continue planing and ripping to make the remaining parts D, E, and F to the dimensions shown on the drawing.

Along the top front edge of part E, cut a rabbet that matches the width and thickness of a standard 12" hacksaw blade with 32 teeth per inch. Then, edge-glue and clamp Parts A–E together as shown, with the bottom surfaces flush. After the glue dries, crosscut the panel to length. Cut the bench hook cleat (F) to length also, and glue and clamp it to the bottom of the jig, flush with the front edge. After the glue dries, apply clear satin-finish polyurethane.

Cut the ends off the hacksaw blade so it measures 11½" long. Adhere it into the rabbet along the front edge of the jig with contact cement or epoxy.

Using the jig

To tear sandpaper to size, simply lay the edge of the sheet against the stepped ledge on the jig that corresponds to the length or width you want, and then tear downward against the hacksaw blade, as shown *above*. For ⅙ or ¼ sheets, you'll need to tear the paper, rotate it, and tear again.

Project design: **Lynn Lawrenz, Algoma, Wis.**

What's Ahead

A sneak peek inside the July 2009 issue (on sale May 12)

Glass-Door Bookcase

Plywood makes construction quick, and solid-wood edging dresses it up. Even if you've never built doors before, we have a foolproof way to make them fit perfectly. And wait until you see our secret to building the frame-and-panel sides in a fast and straightforward way.

Picnic Table with Seating

When it's time for outdoor entertaining, this table is ready to party. Built from weather-resistant cedar, it seats eight and holds a feast.

Jewelry Box

Beautiful bling deserves a glamorous home. Detailed moldings, brass hardware, and felt lining throughout highlight this handsome miniature cabinet.

Three Jointer/Planers Compared

Thinking of a larger jointer and planer, but your shop is tight on space? Consider getting a combination machine that does the work of both.

Basic Cabinet Making

If you've been making excuses instead of cabinets, master these simple skills for building a custom cabinet with no-fuss doors and drawers.

Circ Saw Joinery

When you need half-laps on large workpieces, turn to the smallest saw in your shop. We'll show you how to get tablesaw-like accuracy with this tool.

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